4 ENVIRONMENTAL CONSEQUENCES

This chapter discusses the environmental consequences associated with the five alternatives described in Chapter 2 — (1) the Modified Consolidator Corridors Route (the applicant's and DOE's preferred alternative), (2) the Consolidated Corridors Route, (3) the Previously Permitted Route (the No Action Alternative), (4) the MEPCO South Route, and (5) the Rescission of the Presidential Permit — and includes a discussion of the impacts from the installation of AC mitigation for the M&N gas pipeline (a connected action). The impacts discussion is presented for the resource areas presented in Chapter 3, plus health and safety (including noise). The CEQ's regulations require that an EIS contain a description of the environmental effects (both positive and negative) of the analyzed alternatives. CEQ regulations (40 CFR 1508.8) distinguish between direct and indirect effects. Direct effects are caused by an action and occur at the same time and place as the action. Indirect effects are reasonably foreseeable effects caused by the action that occur later in time or farther in distance. Both direct and indirect effects are addressed in this chapter.

4.1 AIR QULITY

This section evaluates the impacts of construction, operation, and maintenance of the proposed project on the air quality and climate along each alternative route.

4.1.1 Methodology

The potential for air quality impacts was evaluated by analyzing the expected nature and magnitude of air emissions generated during construction activities. The air quality impacts discussion focuses on the construction phase of the project as the primary activity with the potential to impact air quality. This evaluation includes potential air emissions that could occur during construction of each alternative from fugitive dust (dust that escapes from a construction site) and vehicle and equipment exhaust. Mitigation measures to avoid potential nuisance dust conditions and minimize construction equipment impacts are also discussed.

4.1.2 Potential Impacts

4.1.2.1 Alternative Routes

4.1.2.1.1 Potential Impacts on Weather and Climate. The construction and operation of the proposed project along any of the alternative routes would not alter the climate of the project area. Although the openness of a ROW could result in more extreme temperatures, greater winds, convective heat loss, and greater amounts of precipitation (including snow) reaching the ground within the ROW, these areas potentially experiencing microclimatic changes would be proportional to the amount of new ROW required for each alternative route. Thus, the areas where microclimatic changes would occur would be greatest for the Previously Permitted Route (1,278 acres [517 ha]), least for the Consolidated Corridors Route (41 acres [17 ha]), and intermediate for the Modified Consolidated Corridors and MEPCO South Routes (309 acres [125 ha] and 804 acres [325 ha], respectively).

4.1.2.1.2 Potential Impacts on Air Quality. The principal sources of emissions associated with construction of the proposed project would include (1) fugitive dust from land clearing, drilling, excavation (including some explosives blasting), earthmoving, traffic, and wind erosion of exposed ground surfaces, and (2) exhaust from construction equipment and vehicles. At any time, construction would occur within small segments, last only a few days or less, and then cease. Similar, but less extensive, impacts would occur from site maintenance activities. These activities could generate a release of fugitive dust (PM_{10} and $PM_{2.5}$) and combustion products (oxides of nitrogen [NO_x], CO).

The greatest project-related impact on air quality would be from fugitive dust generated during clearing and construction activities. Fugitive dust would be highest in the immediate vicinity of construction activities and along unpaved roads; however, levels would decrease rapidly within a few thousand feet (Etyemezian et al. 2003). Dust emissions would vary substantially from day to day depending on weather, level of activity, and specific operation. Even temporary impacts on air quality from fugitive dust emissions during construction would be controlled by standard mitigation practices to avoid temporary exceedances of the PM_{10} and $PM_{2.5}$ standards. Standard mitigation practices used to mitigate air quality impacts during construction would include mulching exposed soil areas until these areas are revegetated. Furthermore, clearing and construction to the extent feasible during winter, coupled with revegetation during other seasons as construction progresses, would minimize fugitive dust emissions. Ground-cover vegetation would also be maintained to the extent practicable. In addition, Maritimes would follow its established mitigation procedures (TRC 2002) when installing AC mitigation (see Section 2.3.5).

The use of construction vehicles and equipment would also result in the emission of criteria air pollutants (other than O_3). All construction and vehicle use would be limited to the proposed project ROW and substations, staging areas, access roads, and, as applicable, the M&N gas pipeline ROW. Impacts from vehicle and equipment emissions would be minor and transitory because of the mobility of the sources and short work schedule anticipated for any particular site. Thus, these emissions would neither cause nor contribute to any violations of air quality standards. Given that the construction would be temporary (e.g., only 1 day or less per support structure location) and most of the adjacent land is primarily commercial forest land, only minor air quality impacts are expected to occur from construction, including construction vehicle use. Periodic crew vehicles and gas-powered equipment would be required to perform vegetation maintenance within the ROW. Air emissions from these sources would be less extensive than during construction.

The potential would exist for trace amounts of O_3 production resulting from corona effects, that is, the electrical breakdown of air into charged particles around the conductors, as explained in Section 4.10.2.1.4. During damp or rainy weather (the peak conditions for corona effects), the O_3 produced from this type of transmission line is less than 1.0 ppb in the immediate vicinity of the conductors (DOE 2005). This is considerably below the 8-hour and 1-hour O_3 standards of 80 ppb and 120 ppb, respectively (Table 3.1-1). Corona would be minimized by line design.

In summary, impacts on ambient air quality from fugitive dust emissions or the release of gaseous pollutants would be localized and temporary for all alternative routes. All of the alternative routes are located in attainment areas. Therefore, a conformity review is not required for the proposed project. Compliance with State permit provisions and the use of standard mitigation practices and mitigation to control fugitive dust generation and emissions would ensure that Maine ambient air quality standards were not violated. Given the limited emissions that would occur from the proposed project, it would not be subject to New Source Review permitting under the CAA.

4.1.2.2 Rescission of the Presidential Permit

Under the Rescission of the Presidential Permit Alternative, BHE would not build the NRI. Therefore, there would be no impacts on air quality beyond those already occurring.

4.2 LAND FEATURES

This section evaluates the potential impacts on the surface topography, geology, and soil resources within each alternative route from the construction, operation, and maintenance of the four alternative transmission line routes. Construction activities represent the principal means by which these resources could be affected, because they may alter surface topography and physically disrupt the structure of soils. The types of impacts can include the physical disturbance and excavation of soils and surficial geological resources, compaction, erosion, and contamination. This section also addresses the potential earthquake hazard to the proposed project.

4.2.1 Methodology

The main elements considered in assessing impacts on physiographic, geologic, and soil resources were the amount and location of land disturbed during construction. Land could be disturbed during grading for new temporary access roads, excavating for support structures, substation expansions, staging of equipment in designated areas, and installation of AC mitigation, and the degree to which an alternative may adversely affect resources within the designated area of concern.

4.2.2 Potential Impacts

4.2.2.1 Alternative Routes

The surface topography, geology, and soils within each alternative route would be similarly affected by construction activities. Compared with the scale of the landscape that would be crossed by the proposed project, the change in surface topography caused by the construction and operation of the transmission line would be insignificant. The removal of geologic material that would be required for substation expansions and possibly upgrading of existing access roads would be very small relative to the availability of the material in the region. Stone and gravel resources to be used to backfill support structure foundations holes and, as necessary, for access road upgrades would be acquired locally. Supply pits have the capacity to supply the project without the need for new sources of stone and gravel. Sand and gravel resources are ample in the general area; thus, the use of sand and gravel for the proposed project would not strain the supplies of these materials for other local construction needs.

The installation of support structure poles would vary with local surface geology. For most areas that are overlain with soil and glacial deposits, excavation would be conducted with earth augers or backhoes. However, in very dense glacial till and bedrock, excavation would be performed by means of drilling and blasting. Each wood pole would require the excavation of up to 180 ft^3 (5.1 m^3) based on a surface area of 15 ft^2 (1.4 m^2) and a depth up to 12 ft (3.7 m), while each steel pole would require the excavation of up to 450 ft^3 (12.7 m^3) based on a surface area of 15 ft^2 (1.4 m^2) and a depth up to 30 ft (9.1 m). Therefore, on the basis of the number and types of support structures required (Table 2.3-1), the total excavation required for support structure installation is provided in Table 4.2-1. The wood poles would be placed in excavated holes and backfilled with the excavated material or crushed stone that is tamped in place. Excavated holes for the steel poles would be either backfilled with concrete or else the poles would be attached to concrete bases. Excess excavated materials would be disposed of on site with regard for drainage, erosion, and revegetation considerations.

The placement of the support structures and temporary access roads would require some disturbance and removal of near-surface material. Because of the low relief (relatively flat landform) of most of the project area, the potential for slope failure would be negligible. Each of the alternative routes would avoid prominent topographic features such as Pocomoonshine Mountain. Avoiding such prominent topographic features would contribute to mitigation of potential visual impacts.

Localized minor terrain changes might result from the construction of new temporary access roads, the installation of pole structures, and the modification of the substations. The applicant has mitigation measures in place to minimize soil impacts (Sections 2.4.1 and 2.4.3).

Most soil disturbance would occur during the construction phase of the project. The degree of impact and its duration would depend on construction activities, soil characteristics at the construction site, and construction season. Most soil disturbances would be limited to the

TABLE 4.2-1 Excavation and Surface Area Disturbance Required for the Alternative Routes

Alternative Route[a]	Soil Excavation for Support Structures (yd^3)[b]	Disturbance for AC Mitigation (acres)[b]	Disturbance for Temporary Access Roads (acres)
MCCR	9,097	82	0
CCR	11,913	82	0
PPR	7,933	82	21.3
MSR	12,347	54	32.4

[a] CCR = Consolidated Corridors Route, MCCR = Modified Consolidated Corridors Route, MSR = MEPCO South Route, PPR = Previously Permitted Route.

[b] To convert cubic yards to cubic meters, multiply by 0.765; to convert acres to hectares, multiply by 0.405.

Sources: BHE (2004, 2005); Paquette (2005dd,mm,nn).

footprint of individual support structures or other facilities, along temporary access roads, and where AC mitigation is installed. The potential for soil disturbance would be highest for the MEPCO South Route and lowest for the Previously Permitted Route (Table 4.2-1). Increases in erosion are likely to occur when the soil is exposed or disturbed and would occur until sufficient revegetation has occurred to replace soil-retaining ground cover (i.e., 1 year or less). Except for the footprint of the support structures and other NRI facilities and the trench for installation of AC mitigation, ground-cover vegetation would normally not have to be removed. The potential for erosion of disturbed soils would be greatest during heavy rainfall or during spring snowmelt conditions. Soil compaction could also occur as a result of vehicle traffic on access roads and heavy equipment use within work areas for construction and installation of support structures. However, most of the construction activities in sensitive areas would be conducted in winter when the soil surface is frozen and when precipitation events take the form of snowfall. Thus, the potential for soil erosion or compaction as a result of construction would be minimized. In addition, erosion and sediment controls would be utilized (Sections 2.4.1 and 2.4.2) during all construction activities to further reduce the extent and magnitude of soil erosion from construction areas. Thus, impacts from soil disturbance would be expected to be negligible.

Installation of AC mitigation could disturb soil structure, increase erosion, or compact local soils. Removal of vegetation, trenching, grading, and backfilling can destabilize the soil surface and increase erosion potential (FERC 1998). The approximate areas disturbed for AC mitigation are provided in Table 4.2-1 for each alternative route. Soil erosion is expected to be minor and temporary as the trench required to install the zinc ribbon would be 18 in. (46 cm) deep and less than 3 ft (1 m) wide and would be backfilled as work progresses. Maritimes has erosion control measures in place to control soil erosion (TRC 2002).

Within the new temporary access roads, lack of vegetation would promote erosion of fine particles. The acreages occupied by new temporary access roads for each alternative route are provided in Table 4.2-1. If these roads were not properly located, graded, and maintained, concentrated runoff could cause gully erosion. However, adverse impacts would not be expected because the access roads would only be needed for a short period. Upon completion of use, the new temporary access road areas would be regraded to their approximate original ground contours, seeded, and mulched (Section 2.4.3).

In addition to physical disturbance, soils could be contaminated during construction and maintenance of the proposed project (fuel and herbicide spills). However, because standard mitigation practices would be used and any accidental spills would be promptly cleaned up as required (Section 2.4.2), chemical impacts on soils would be small. In addition, the herbicides that would be used bind tightly to soil (Information Ventures, Inc. 1995); thus, only the immediate area of the spill would be affected. Herbicides would be applied in accordance with label and application permit directions and stipulations.

Overall, the impacts on the physiographic, geologic, and soils resources are expected to be minimal and localized to the proposed project work areas.

The alternative routes are located in areas of relatively low seismic activity. In addition, transmission lines are designed to withstand a considerable amount of bending and twisting; therefore, seismic activity in the project area would have little or no effect on the NRI.

4.2.2.2 Rescission of the Presidential Permit

Under the Rescission of the Presidential Permit Alternative, BHE would not build the NRI. Therefore, there would be no potential impacts on land features (physiography, geology, and soils) beyond those already occurring.

4.3 LAND USE

4.3.1 Methodology

Potential impacts on land use were evaluated for each alternative route by examining the amount of land that would be disturbed by construction, the current land use of the potentially disturbed areas, and the compatibility of the transmission line ROW and facilities with current land use designations. Land disturbance activities for the NRI project would include ROW clearing and the construction and installation of new temporary access roads, staging areas, erosion controls, and support structures. Additional activities would include expanding substation areas and adding AC mitigation to the existing M&N gas pipeline.

4.3.2 Potential Impacts

4.3.2.1 Alternative Routes

ROW clearance and support structure installation are the main activities under the proposed action that could result in impacts on land use. The line length of each of the alternatives, except for the MEPCO South Route, would be relatively similar (84 to 85 mi [135 to 137 km]). The MEPCO South line would be 114 mi (183 km) long. The following discusses the potential impacts on various types of land uses that could occur along the alternative routes.

Less than 0.03% of the forest land within the three-county area of Hancock, Penobscot, and Washington Counties (Tables 3.5-4 and 3.5-5) would be affected by development of the ROW for any of the four alternative routes. Table 4.3-1 lists the acres of forested land (both managed and unmanaged) that would be impacted by ROW clearing for the alternative routes. The cleared trees could be used for commercial purposes (BHE 2004). The land within the ROW would be removed from commercial forest production. However, the presence of the proposed project would not restrict the continuation of commercial forestry in areas adjacent to the ROW. The Previously Permitted Route crosses about 40 mi (64 km) of land owned by International Paper, and logging operations along this portion of the route could be disrupted.

TABLE 4.3-1 Acres of Land Use Affected by the Alternative Routes[a]

	Alternative Route[b]			
Land Use	MCCR	CCR	PPR	MSR
Forested	1,411	1,391	1,461	1,513
Agricultural[c]	30	28	28	86
Other[d]	125	103	144	135
Total	1,566	1,522	1,633	1,734

[a] To convert acres to hectares, multiply by 0.405.

[b] CCR = Consolidated Corridors Route, MCCR = Modified Consolidated Corridors Route, MSR = MEPCO South Route, PPR = Previously Permitted Route.

[c] Acres of agricultural land crossed by the ROW. Production within most of the acreage could continue.

[d] Other land use includes built-up lands, such as urban, industrial, and residential lands.

Sources: BHE (2004); Paquette (2005j).

A small amount of agricultural land would be impacted by the proposed action for any of the alternative routes (Table 4.3-1). In the three-county area, there are more than 300,000 acres (120,000 ha) of land in farms (USDA 2004), and less than 0.03% of this agricultural land would be affected by any of the four alternatives. The presence of the ROW would not restrict the continuation of agricultural land use. It is probable that some support structures would be placed within agricultural lands. Although each support structure pole would occupy only about 15 ft^2 (1.4 m^2), up to 0.03 acre (0.01 ha) of agricultural land per support structure would be excluded from production because of constraints on farm equipments use within the immediate area of the support structures, including guy wires (Gustafson et al. 1980). Total acreage lost from production could be conservatively estimated by multiplying the percentage of the ROW that is agricultural land by the number of support structures for each alternative route. Thus, maximum acres lost to production would, in the aggregate, only be 0.35 acre (0.14 ha) for the Modified Consolidated Corridors and Consolidated Corridors Routes, 0.29 acre (0.12 ha) for the Previously Permitted Route, and 1.32 acres (0.53 ha) for the MEPCO South Route.

Impacts on recreational land use would be predominantly visual and experiential (Section 4.9) because no land would be taken out of or removed from recreational use as a result of the proposed project. Similarly, no State or Federal lands (including National Natural Landmarks) would be affected by construction or operation of any of the alternative routes. The Modified Consolidated Corridors, Consolidated Corridors, and Previously Permitted Routes would be within the viewshed of Outstanding River Segments on the Narraguagus and Machias Rivers. The types of outdoor activities described in Section 3.3 (e.g., fishing, hiking, camping, wildlife viewing, canoeing, snowmobiling, and ATV use) could be affected by the visual presence of the transmission line and its ROW in certain areas.

Establishment of the ROW could increase the amount of snowmobiling and ATV use since transmission line ROWs are frequently used for such activities. In particular, the Previously Permitted Route would create 19 potential ATV impact areas (e.g., new access areas connecting established trails). Only one new access area would be established for the MEPCO South Route and none for the Modified Consolidated Corridors or Consolidated Corridors Routes. The ROW corridors could also provide increased access for hunting. The indirect impacts of increases in these activities on other natural and cultural resources are discussed in Sections 4.5 and 4.6.

Residential land use could be affected by the proposed action either visually (a transmission line located within the viewshed of a residence) or through property being taken by condemnation through BHEs eminent domain rights as a public utility. Ten dwellings could be displaced by the MEPCO South Route. The Modified Consolidated Corridors Route would not displace any dwellings, and the Previously Permitted and Consolidated Corridors Routes would displace two and three dwellings, respectively. It is possible, however, that route adjustments could be made to avoid some of these properties.

Table 3.3-3 lists the number of dwellings that occur within 600 ft (183 m) of the alternative routes. The value or attractiveness of these dwellings could be affected by their proximity to the ROW. Potential impacts would be highest for the MEPCO South Route (with 121 dwellings) and least for the Previously Permitted Route (with 35 dwellings). Recreational land use in campgrounds could also be affected in four seasonal camps that are in the vicinity of the Modified Consolidated Corridors and the Previously Permitted Routes.

Approximately 4 acres (1.7 ha) of submerged Native American lands would be crossed by the ROW for the MEPCO South Route near the Penobscot River. Because of the nature of these lands (submerged) and on the basis of discussions between the applicant and the Penobscot Indian Nation (BHE 2005), use of these 4 acres (1.7 ha) of submerged land would not be expected to be affected by the MEPCO South Route. No Native American lands are crossed under the other alternatives (BHE 2005; Paquette 2005j).

Additional areas of disturbance that would affect land use include the construction of new temporary access roads, substation expansions, and AC mitigation. Substation expansions and AC mitigation would occur in previously disturbed areas and, therefore, would not be expected to affect existing land use. The construction of new temporary access roads would not result in any permanent change in land use. Estimated acreages required for new temporary access roads are none for the Modified Consolidated Corridors and Consolidated Corridors Routes, 21 acres (8.5 ha) for the Previously Permitted Route, and approximately 32 acres (13 ha) for the MEPCO South Route. These areas would need to be cleared for temporary access during construction of the transmission line but would be returned to preexisting conditions upon completion of construction activities (Section 2.4.3). Thus, only a temporary, short-term effect, if any, on land use would be expected for the construction of temporary access roads, and no land use impacts would be expected for any substation expansions or for AC mitigation.

Other lands, such as residential, commercial, and transportation and utility corridors, are also present in the proposed project area (Table 4.3-1). Most of these areas would be unaffected by the presence of a new transmission line.

4.3.2.2 Rescission of the Presidential Permit

Under the Rescission of the Presidential Permit Alternative, BHE would not build the NRI. Therefore, there would be no land use impacts beyond those already occurring.

4.4 HYDROLOGICAL RESOURCES

This section discusses the potential impacts of the proposed project on hydrological resources in the project area for each alternative. The discussion is divided into potential impacts on surface water and potential impacts on groundwater.

4.4.1 Methodology

Potential impacts on hydrological resources were evaluated by determining activities that could change the quantity and quality of surface and groundwater. To evaluate impacts on surface waters, consideration was given to (1) the number and types of water bodies that would be crossed by the alternative routes, and (2) the number of water bodies crossed or impacted by related actions (e.g., construction of new temporary access roads and AC mitigation for the M&N gas pipeline) and the physical effects of the crossings on water quality and flow, if any. Potential impacts on groundwater were based on the likelihood of an action associated with construction or maintenance of the proposed project physically altering or contaminating groundwater resources.

4.4.2 Potential Impacts

4.4.2.1 Alternative Routes

4.4.2.1.1 Potential Impacts on Surface Water. Potential impacts on local surface waters from construction of the proposed project could include degradation of water quality and alteration of flow regimes. During the construction phase, clearing of vegetation, support structure installation, placement of temporary access roads, installation of AC mitigation, and movement of construction vehicles and equipment could disrupt soils and promote soil erosion and sedimentation.

While a similar number of stream crossings would occur under each alternative route, the Previously Permitted Route would cross the greatest number of Class AA streams (Table 4.4-1). The applicant would span the streams and rivers and avoid placing support structures within

TABLE 4.4-1 Summary of Stream Crossings for the Alternative Routes

Alternative Route[a]	No. of Stream Crossings	No. of Class AA[b] Crossings	No. of Class A[c] Crossings
MCCR	67	13	44
CCR	66	10	46
PPR	65	18	41
MSR	66	5	41

[a] CCR = Consolidated Corridors Route, MCCR = Modified Consolidated Corridors Route, MSR = MEPCO South Route, PPR = Previously Permitted Route.

[b] Class AA = highest classification for rivers and streams; applies to waters that are outstanding natural resources and that should be preserved because of their ecological, social, scenic, or recreational importance (MDEP 2004).

[c] Class A = second-highest classification for rivers and streams (MDEP 2004).

Source: BHE (2004).

stream buffer zones (Section 2.4.2). BHE would avoid placing support structures within 75 ft (23 m) from the top of stream banks (25 ft [7.6 m] for the portion that would parallel the existing 345-kV transmission line). However support structures would be placed as close as possible to Atlantic salmon streams of special concern in order to maximize conductor height near the streams. This would minimize the amount of clearing required, which would help to maintain stream temperatures. Construction-related water use would not require withdrawals from regional surface water sources (BHE 2005).

No AC mitigation would be installed within streams or rivers; therefore, no in-stream disturbance would occur from this connected action. In addition, Maritimes would follow its established mitigation practices when installing AC mitigation (TRC 2002). Grand Falls Flowage would be the only lake crossed by any of the alternative routes (MEPCO South). It would be crossed at one of its narrowest areas (although this would require a span of about 1,150 ft [350 m]), and the crossing would be conducted similar to a stream or river crossing. Other ponds and lakes could be indirectly affected if streams that drain into such water bodies receive high sediment loads from construction areas or overland runoff of contaminants. Such impacts would be short-term and minor.

Because standard mitigation practices for erosion control and vegetation management protocols would be followed (Sections 2.4.2 and 2.4.3), only negligible impacts on water bodies would occur from erosion and sedimentation regardless of the alternative route. Erosion control measures would include the use of siltation fencing, hay bales, and geotextile fabric in areas where erosion is likely to occur, together with selective clearing within stream buffer zones. In addition, because the vast majority of the ROW would remain vegetated during construction, there would be no significant change in storm water runoff characteristics such as peak discharge rates. Thus, no special mitigation measures would be necessary to control peak flow from the ROW. These standard mitigation practices would minimize the potential for water bodies to be affected during construction.

In upland areas, both the refurbished and new temporary access roads could promote soil erosion, resulting in increased sediment loads in local brooks and streams. These impacts would be transient. Because erosion and sediment control measures would be implemented (Sections 2.4.2 and 2.4.3), the impacts caused by the new temporary access roads would be minor and localized. Only the MEPCO South Route would require a stream crossing for a new temporary access road; none would be required for the other alternative routes. Standard mitigation practices would be employed to minimize or avoid impacting water quality at the stream crossings (Sections 2.4.2 and 2.4.3).

Fuel and oil spills could occur during service and maintenance of equipment and vehicles, especially in the staging areas. However, the applicant has an oil and hazardous material spill containment plan in place that would minimize the potential threat of surface water contamination (BHE 2005).

Tree removal from shoreline locations can raise water temperatures, primarily through the removal of shade. The water bodies most at risk are low-order streams rather than larger, main-stem rivers (Lansky 2004). Deforestation can result in a 3.6 to 9.0°F (2 to 5°C) warming of small streams (Sweeney 1993). Because ROW stream crossing widths would affect relatively short segments of streams (up to 170 ft [52 m]), they would have little impact on stream temperatures. Loss of shading generally gains importance only if it occurs where other activities are also causing losses in riparian shading (BPA 2000). The applicant has standard mitigation practices in place to minimize impacts within stream buffers, such as selective removal of trees or portions of trees to minimize impacts on riparian vegetation (Section 2.4.2). Therefore, thermal warming of streams is not expected for any of the alternative routes.

During operation, potential impacts on hydrological resources would primarily occur from ROW maintenance. The potential for erosion and sedimentation is less than that for construction because removal of ground vegetation would not be required and only capable and danger trees would be removed. Potential stream contamination could occur from herbicide application. However, the herbicides that would be used to maintain the NRI ROW (i.e., imazapyr, glyphosate, and fosamine) are strongly adsorbed to soil (Information Venture, Inc. 1995). Also, herbicides would not be applied within stream buffer zones and would only be applied selectively in other areas (Section 2.4.5). Herbicides would be applied in accordance with label and application permit directions and stipulations. Therefore, their potential to contaminate surface waters would be negligible for any of the alternative routes.

No support structures would be located in streams. Because of the small footprint that a support structure would possess (15 ft^2 [1.4 m^2] per pole), the placement of structures in floodplains would not be expected to result in any increase in flood hazard either as a result of increased flood elevation or because of changes in the flow-carrying capacity of the floodplain. The support structure poles would not exacerbate flooding since they would not impede floodwater movement or reduce floodwater storage capacity. Also, very few support structure poles would be located in floodplains. For example, 13 poles would be placed within mapped 100-year floodplains for the Modified Consolidated Corridors Route (BHE 2005). In accordance with MDEP's Site Location Law, the NRI would not cause or increase flooding or cause a flood hazard to any structure and would not have an unreasonable effect on runoff infiltration. Substation modifications would be designed, constructed, and maintained so that flooding extent and frequency of flooding to downstream water bodies would not be increased and so that the 100-year flood elevation would not be adversely affected (BHE 2005). Impacts on floodplains and flooding are therefore expected to be insignificant. A detailed analysis of potential floodplain impacts is provided in the wetland and floodplain assessment in Appendix E.

4.4.2.1.2 Potential Impacts on Groundwater. Groundwater could be affected as a result of alterations of localized groundwater recharge rates due to soil compaction during clearing and grading. Trench excavation for AC mitigation could intersect shallow groundwater but would not be expected to adversely affect groundwater quality, quantity, or flow characteristics. For all alternative routes, some blasting for support structure holes may be necessary in areas where bedrock is exposed or close to the surface. Rock fracturing during blasting can affect the properties of bedrock aquifers that transmit water in fractures. The effect, however, has been shown to be confined to the immediate area of the detonation, thus minimizing potential impact on groundwater systems outside the construction ROW (FERC 1998).

During construction, collected water may need to be removed from support pole structure holes, from the AC mitigation trench in areas where there is a high water table, or following heavy precipitation events. This dewatering could minimally lower the water table in the immediate vicinity of the holes (e.g., within a few feet), but because this effect would be highly localized and temporary, there would be no impacts on nearby water users. Dewatering impacts would be minimized by discharging all water into well-vegetated upland areas or properly constructed dewatering structures that would allow the water to infiltrate back into the ground and return to the aquifer (BHE 2005; FERC 1998). Construction activities would not involve on-site subsurface wastewater disposal (BHE 2005).

The storage and use of fuel, lubricants, and other fluids during the construction phase of the facilities could create a potential contamination hazard. Spills or leaks of hazardous fluids could contaminate groundwater and affect aquifer use. This impact would be minimized or avoided by restricting the location of refueling activities and by requiring immediate cleanup of spills and leaks of hazardous materials (BHE 2005). Oil and diesel fuel would be stored in clearly marked tanks at the staging areas, and these areas would be provided with secondary containment structures. Construction equipment would be maintained regularly, and the source of leaks would be identified and repaired. Any soil contaminated by fuel or oil spills would be removed and disposed of by a contractor to an approved disposal site (BHE 2005). Lubricating oils and concrete curing compounds are potentially hazardous wastes that may be associated with construction activities. These would be placed in containers within secondary containment structures on site and disposed of at a licensed treatment and/or disposal facility in accordance with local or State regulations and in compliance with manufacturer's recommendations (BHE 2005). Any potentially contaminating materials would be removed before they could migrate downward to the groundwater (BHE 2005).

The potential for any herbicide to reach groundwater depends on factors like soil adsorption, soil characteristics, degradation rate of the herbicide, use rate, and climatic conditions (DuPont 2005). The herbicides that may be used to maintain the NRI ROW (i.e., imazapyr, glyphosate, and fosamine) strongly adsorb to soil (Information Venture, Inc. 1995). The potential impacts would be further minimized by prohibiting the application of herbicides in sensitive areas, such as where the sand and gravel aquifers are exposed and where water supply wells are located (TRC 2005b). Herbicides would be applied in accordance with label and application permit directions and stipulations (Section 2.4.5). Therefore, their potential to contaminate groundwater would be negligible for any of the alternative routes.

4.4.2.2 Rescission of the Presidential Permit

Under the Rescission of the Presidential Permit Alternative, BHE would not build the NRI. Therefore, there would be no impacts on hydrological resources beyond those already occurring.

4.5 ECOLOGICAL RESOURCES

This section discusses the potential effects on ecological resources from the construction, operation, and maintenance of the proposed project for each alternative route.

4.5.1 Methodology

Direct and indirect impacts on ecological resources were evaluated on the basis of (1) expected changes in habitat quantity, (2) the nature and quality of habitats adjacent to construction footprints, (3) changes in the quality and characteristics of habitats in the affected area, (4) the potential magnitude of changes to habitat quality and quantity, (5) the temporal characteristics of when impacts could occur, (6) the expected duration of impacts, (7) the sensitivity of biological resources that could be affected by changes in habitat quality or quantity, and (8) the rarity and importance of affected resources.

4.5.2 Potential Impacts

4.5.2.1 Alternative Routes

Differences in potential impacts among the alternative routes would primarily relate to factors such as line length, ROW widths, and specific habitats through which each route would traverse. Potential impacts on ecological resources for the first 12.2 mi (19.9 km) from the Orrington Substation to Blackman Stream would be the same for all four alternative routes, which are identical along this segment (Figure 2.1-2). Once past this segment, the nature of potential impacts on ecological resources would be relatively similar for the Modified Consolidated Corridors and Consolidated Corridors Routes, since these routes would only separate from each other southeast of the Sunkhaze Meadows National Wildlife Refuge (Figure 2.1-2) and near Myra Camps (Figure 2.1-5). The Previously Permitted Route (No Action Alternative) is located within the same general corridor as the Modified Consolidated Corridors and Consolidated Corridors Routes. However, the Previously Permitted Route has several lengthy separations from the other two routes (Figures 2.1-2 and 2.1-3). Within these separations, the Previously Permitted Route would be within a new corridor (i.e., not co-located with either the M&N gas pipeline or Stud Mill Road). The MEPCO South Route would be most dissimilar to the other routes because much of it would be located in a different corridor area (Figure 2.1-1).

4.5.2.1.1 Potential Impacts on Terrestrial Vegetation. Regardless of which alternative route is selected, during construction, vegetation would be directly affected by (1) clear-cutting or selective cutting to establish the ROW, (2) clearing of areas for support structures, (3) installation of new temporary access roads, (4) substation expansions, and, where required, (5) installation of AC mitigation for the M&N gas pipeline. Forests (both managed and unmanaged) represent the dominant plant community along each alternative route. The forested areas that would be impacted are common to abundant in the area. Impacts on nonforested habitats (e.g., agricultural areas, nonforested wetlands, and other open lands) would be relatively minor and short term. Following construction, any nonforested areas that were disturbed would be revegetated.

Effects on vegetation outside the construction footprint could include trampling, crushing, or accidental removal of plant species; increased exposure to direct sun and weather; change in plant community composition and diversity; changes in soil moisture, nutrient level, and soil structure due to compaction; and increase in invasive weeds (BPA 2000). The potential effects would be greatest during the growing season; nevertheless, many species would be expected to recover from these impacts by the following growing season (BPA 2000).

Approximately 90% of each alternative route is composed of managed and unmanaged forest habitat. Forest clearing for the project would fragment habitat by creating a new ROW through contiguous forested habitats or by expanding the ROW width where the NRI would be co-located with existing facilities. The expansion would not be considered new fragmentation; therefore, there would be fewer impacts than for a new ROW area. The Previously Permitted and MEPCO South Routes would have 62 and 39 mi (100 and 63 km) of new ROWs, respectively. The Modified Consolidated Corridors Route would have 15 mi (24 km) of new ROW, while the Consolidated Corridors Route would have only 2 mi (3 km) of new ROW. When a forested area is fragmented to create a ROW, trees adjacent to the opening are exposed to microclimatic conditions which, under extreme conditions, can cause the foliage to sunburn or the trees to freeze. The trees that now make up the new forest edge may also be vulnerable to being blown down by winds if their root masses are not strongly developed (BPA 2000). This would vary by species. For example, the shallow roots of balsam fir and red spruce make them susceptible to windthrow, whereas the deep taproot of white pine makes it extremely windfirm (University of Maine 1997). The potential for this to occur along any of the alternative routes would be more likely for new ROW areas where essentially two new forest edges would be established. As previously discussed, the Previously Permitted and MEPCO South Routes would have significantly more new ROW than the Modified Consolidated Corridors and Consolidated Corridors Routes.

Habitat Fragmentation

Habitat fragmentation is the division of a large, contiguous area of habitat into smaller patches that are isolated from one another.

Habitat fragmentation is currently present along all alternative routes and would be one of the environmental consequences of the construction of the proposed project.

Fragmentation may result from human disturbances (e.g., logging, ROW construction, and agriculture) or natural events (e.g., forest fires, ice storms, and major disease or pest infestations).

Soil disturbance can provide microhabitat sites for establishment of invasive plant species that may become management problems in the ROW and/or the surrounding forest (Williams 1995). Invasive species can threaten the existence of many native plants and greatly reduce plant diversity (BPA 2000). Maine's most problematic terrestrial invasive species include several species of honeysuckle (*Lonicera* spp.), Japanese knotweed (*Fallopia japonica*), Japanese barberry (*Berberis thunbergii*), common buckthorn (*Rhamnus cathartica*), Oriental bittersweet (*Celastrus orbiculata*), and multiflora rose (*Rosa multiflora*). Three additional terrestrial species can also invade wetland habitats: common reed (*Phragmites australis*), glossy buckthorn (*Frangula alnus*), and purple loosestrife (*Lythrum salicaria*) (MNAP 2004).

Other possible adverse construction effects could include deposition on plants of dust and other particulates from the operation of vehicles and large machinery. This deposition could inhibit photosynthesis and, if long term, result in plant mortality. The potential for fugitive dust impacts and soil compaction would be largely limited to the immediate footprint of the construction vehicles, construction sites, and temporary access roads, and would not be uniformly distributed or widespread throughout the length and width of a ROW. Vegetation that could be affected by fugitive dust would be largely limited to that immediately adjacent to the construction areas and temporary access roads. However, because construction activities at any one point would be short term and travel along access roads would be limited, adverse impacts on vegetation from dust should be negligible.

In addition, soil compaction caused by heavy machinery could destroy the ground flora and indirectly damage (by reducing soil aeration and altering soil structure) roots of trees (even of trees outside the ROW whose roots extend into the ROW). Impacts due to soil compaction would be mitigated (Section 2.4.2).

The acreage of forest clearing for each alternative route that would be converted to scrub-shrub or herbaceous habitats would be similar for all four routes (Table 4.5-1). Table 4.5-1 also presents the acreage of clearing or disturbance that would be required for new temporary access roads, substation expansions, staging areas, and AC mitigation for each alternative. The impacts resulting from new temporary access roads and AC mitigation would be short term and reversible, since those areas would be restored following completion of construction. While most impacts in staging areas would also be short term and reversible, some of the habitats within some of the staging areas are already disturbed (Section 2.3.4). Staging areas would be stabilized following their use (BHE 2005). The substation expansions would result in a permanent loss of habitat. Because some staging areas are being used or have been recently used for other activities, the habitats in these areas are currently disturbed. Therefore, their use for ROW construction would not be expected to result in additional habitat impacts.

No rare natural communities would be located within the ROW for the MEPCO South Route. Within the ROWs for the other alternative routes, the acreage of rare natural communities would be as follows: Modified Consolidated Corridors Route — 7.4 acres (3.0 ha); Consolidated Corridors Route — 3.4 acres (1.4 ha); and Previously Permitted Route — 7.9 acres (3.2 ha). Although some of these areas may be reduced in size or modified, the applicant has mitigation measures in place to minimize potential impacts on these areas (Section 2.4.2). For example, to the extent practicable, support structures would not be placed within rare natural communities, and construction activities within these areas would be closely monitored. Rare natural communities adjacent to any of the alternative ROWs would not be destroyed or modified by construction activities.

Commercial forest land within the project area goes through a cutting cycle that includes a 20- to 80-year period of reforestation (McWilliams et al. 2005). The vegetation within the ROWs

TABLE 4.5-1 Area Potentially Impacted by ROW Access Roads, Substation Expansions, Staging Areas, and AC Mitigation

	Area (acres) per Alternative[a,b]			
Activity (Extent of Impact)	MCCR	CCR	PPR	MSR
Total ROW acreage (permanent)	1,566	1,522	1,633	1,734
Acreage of new ROW (permanent)[c]	309	41	1,278	804
Forest clearing (permanent)[d]	1,411	1,391	1,461	1,513
New access roads (temporary)	0.0	0.0	21	32
Substation expansions (permanent)	1.0	1.0	1.0	1.0
Staging areas (temporary)	42.0	42.0	42.0	57.0
AC mitigation (temporary)	82	82	82	54

[a] CCR = Consolidated Corridors Route, MCCR = Modified Consolidated Corridors Route, MSR = MEPCO South Route, PPR = Previously Permitted Route.

[b] To convert to hectares, multiply by 0.405.

[c] New ROW would exist where the NRI would not parallel existing ROWs.

[d] Forests would be converted to scrub-shrub or herbaceous habitats.

Sources: BHE (2004, 2005); Paquette (2005j,ll,mm).

would, however, be maintained in an early successional state, with maintenance performed on an average 4-year cycle by selective hand cutting and herbicide application (Section 2.3.6). The herbicides that would be used to control woody vegetation within the ROW would be approved by the EPA and the Maine Board of Pesticides Control. Herbicides would be applied only by means of selective basal spray by workers using hand-held applicators rather than a broadcast application throughout the ROW. In comparison with herbicide use, mechanical methods to control vegetation generally cause a loss of diversity, reduce wildlife habitat (e.g., habitat becomes cyclic rather than stable), and increase the potential for petroleum product pollution. Selective basal herbicide application is an ecologically desirable means of encouraging the development of relatively stable shrublands, thereby decreasing the number of invading tree seedlings, and could potentially reduce the amount of future herbicide usage (Dreyer and Niering 1986).

The degree to which herbicides affect nontarget vegetation depends on (1) which specific herbicide is used (whether it is selective or nonselective), and (2) whether the herbicide comes in contact with nontarget vegetation (from application technique, drift, water or soil movement, and accidental spills or applications) (BPA 2000) (see Section 2.3.6). The herbicides that would be used bind tightly to soil (Information Ventures, Inc. 1995); therefore, their effects are primarily limited to foliar contact. Potential effects on nontarget plants would be limited to only those plants very near treated areas that are in a sensitive growth stage at the time of contact (Giesy et al. 2000).

In addition, mitigation measures (e.g., no herbicide use within stream buffers or wetlands with standing water) (Section 2.4.5) would further minimize potential herbicide effects.

4.5.2.1.2 Potential Impacts on Wildlife. Construction of a transmission line could directly affect wildlife as a result of (1) habitat loss, alteration, or fragmentation; (2) disturbance and/or displacement from noise and construction activities; (3) mortality from collisions with conductors and shield wires; (4) obstruction to movement; and (5) chronic or acute toxicity from herbicide or fuel spills. The nature of potential qualitative project impacts on individual wildlife species is summarized in Tables D-1 (mammals), D-2 (birds), and D-3 (reptiles and amphibians) of Appendix D. A qualitative assessment of potential impacts was made on the basis of whether the proposed project would increase preferred habitat (beneficial impact), decrease preferred habitat (detrimental impact), not notably alter preferred habitat (neither a net beneficial nor adverse impact), or have seasonally variable impacts. Wildlife species least likely to be affected by the NRI, either beneficially or adversely, would be habitat generalists.

The creation of edge habitat along the boundary between two habitats can (1) increase predation and parasitism of vulnerable forest interior animals in the vicinity of edges; (2) have negative consequences for wildlife by modifying their distribution and dispersal patterns; (3) be detrimental to species requiring large undisturbed areas, because increases in edge are generally associated with concomitant reductions in habitat size and possible isolation of habitat patches and corridors (habitat fragmentation); or (4) increase local wildlife diversity and abundance.

During construction, more mobile species would be displaced from the ROW area to similar habitats nearby; less mobile species, such as small mammals, reptiles and amphibians, and bird eggs and nestlings, could be destroyed. Displaced animals would likely have lower reproductive success because nearby areas are typically already occupied by other individuals of the species that would be displaced (Riffell et al. 1996). As summarized by Earth & Environmental Limited (AMEC 2002), increasing the concentration of wildlife in an area may result in a number of adverse effects, including potential mortality of the displaced animals from depletion of food sources, increased vulnerability to predators, increased potential for the propagation of diseases and parasites, increased intra- and inter-species competition, and increased potential for poaching. Some displaced wildlife would return to the newly disturbed areas shortly after construction is completed.

Principal sources of noise during construction would include truck traffic, operation of construction equipment, and blasting. Construction noise would be expected to temporarily disturb the behavior of local wildlife, causing some individuals to leave the area. Disturbed wildlife would be expected to return to the area after completion of construction activities. Because of existing noise associated with logging operations and associated truck traffic, local wildlife species may be habituated to temporary increases in noise levels.

Vegetation cutting during scheduled ROW maintenance would cause short-term disturbance of wildlife in the immediate vicinity of such activities. Animals that inhabit shrubs and small trees within the ROW would be displaced to adjacent habitats. The relatively low frequency of this activity (i.e., once every 3 to 4 years) would reduce the severity of the impact.

The herbicides that would be used as part of the ROW maintenance program (fosamine, glyphosate, and imazapyr) are considered practically nontoxic to wildlife (BPA 2000) (see Section 2.3.6). Thus, any adverse toxicological threat from herbicides to wildlife is unlikely. The response of wildlife to herbicide use is attributable to habitat changes resulting from treatment rather than direct toxic effects of the applied herbicide on wildlife.

The following discussion addresses potential impacts on mammals, birds, and reptiles and amphibians. Emphasis is given to species that have significant wildlife habitats within the project area (white-tailed deer and waterfowl and wading birds) or other species groups (such as raptors) that are prone to being impacted by transmission lines. Special status species are discussed separately in Section 4.5.2.1.8.

Overall, the effects of the proposed project on wildlife are expected to be minor at the population level and may not be detectable above natural population fluctuations and from fluctuations resulting from other activities in the area (e.g., logging and hunting).

4.5.2.1.3 Potential Impacts on Mammals. Almost half of the mammal species that occur within the region would either not be affected or experience only a minor beneficial or adverse impact because of the alteration of forested habitats to shrub or field habitats (Table D-1, Appendix D). Mammal species that could be adversely affected by the proposed project include those more dependent upon forest interiors (e.g., long-tailed shrew [*Sorex dispar*]). However, because the project area is located mostly within commercial timberlands subject to logging, forest interior specialists would be uncommon to rare. In particular, forest interior specialists would not be expected where the alternative routes would be co-located with existing ROWs or where the routes would pass through recently harvested areas. Other mammal species that could be adversely impacted include those that are arboreal or otherwise dependent upon trees (e.g., squirrels). Some forest species such as marten (*Martes americana*) and fisher (*M. pennanti*) are adversely affected by ROW clearings, which inhibit normal movements of these species (Merriam 1988; DOE 1995).

Mammal species most likely to benefit from the proposed project are those that prefer or require some open areas, edge habitat, and/or shrubs and small trees such as the woodchuck (*Marmota monax*), meadow jumping mouse (*Zapus hudsonicus*), coyote (*Canis latrans*), red fox (*Vulpes vulpes*), long-tailed weasel (*Mustela frenata*), and moose (*Alces alces*). Gravel roads through forests have been found to be positively correlated with bat activity in late spring and summer in eastern Maine (Zimmerman and Glanz 2000), since these areas provide productive foraging areas and/or travel corridors. The NRI would provide similar conditions.

Potential impacts on white-tailed deer are a primary consideration because tree removal could affect deer wintering habitat. Current commercial timber management activities in the vicinity of the proposed route include clear-cutting, selective harvesting, and herbicide applications. Loss of deer wintering habitat is the primary reason for low densities of deer in northern and eastern Maine (MDIFW 2002). Lower temperatures and higher winds in deer yards that are transected by a ROW impose greater thermoregulatory stresses on individual deer. Snowdrifts can be deeper in a ROW than in a deer yard, and they can increase the metabolic costs of travel and cover potentially important sources of winter browse. A ROW can serve as a potential barrier to deer movement within a deer yard or it can directly reduce the amount of yard available to overwintering deer. This could force deer to use suboptimal habitat, which could lead to debilitating stress.

Clearing and subsequent maintenance of a ROW through a deer yard would result in a loss of winter habitat for white-tailed deer. Another negative influence of the ROW on deer is the easy access it provides to the deer yard for humans (including snowmobiles) (Doucet et al. 1981). However, a ROW through a deer yard may increase browse production, especially toward the end of the maintenance cycle. During a harsh winter, this could be a critical survival factor for deer (Doucet et al. 1987).

Although the ROI for all four alternative routes is primarily forested, few deer wintering areas would be affected by construction of any of the routes. One deer wintering area would be crossed by either the MEPCO South Route or the Consolidated Corridors Route, while two would be crossed by the other routes (Table 3.5-5). The potential impact would be minor, especially if the NRI would only cross through the edge of a deer yard. For example, the total acreage for the two deer yards crossed by the Modified Consolidated Corridors Route would be more than 282 acres (114 ha), whereas the ROW portion of the Modified Consolidated Corridors Route would occupy only 7.3 acres (3.0 ha) of these deer yards (BHE 2005). In addition, other deer yards that are located near all of the alternative routes would be unaffected by NRI construction.

4.5.2.1.4 Potential Impacts on Birds. Potential project impacts on bird species are listed in Table D-3 (Appendix D). Open land habitat species such as the red-tailed hawk (*Buteo jamaicensis*), American kestrel (*Falco sparverius*), osprey (*Pandion haliaetus*), brown-headed cowbird (*Molothrus ater*), and yellow warbler (*Dendroica petechia*) may increase in numbers. An increase in brown-headed cowbird populations could adversely affect other species. The brown-headed cowbird is a brood parasite, laying its eggs in the nests of other species, especially of warblers, vireos, and sparrows. Nests along the forest edge could also be more vulnerable to predators such as raccoon (*Procyon lotor*). For example, depredation of artificial avian nests in a forest-field edge in Illinois was found to be 75% by the second day after nest placement and 99% by the sixth day (Bollinger and Peak 1995). If birds are disturbed sufficiently during the nesting season, then nest or brood abandonment might occur, and the eggs and young of displaced birds would be more vulnerable to cold or predators. The density of several forest-dwelling bird species has been found to increase within a forest stand soon after the onset of fragmentation as a result of displaced individuals moving into remaining habitat (Hagan et al. 1996).

Certain raptors, including the barred owl (*Strix varia*) and northern goshawk (*Accipiter gentilis*), could be adversely affected by loss of forest cover and habitat fragmentation. As the ROW becomes more densely vegetated toward the end of each 3- to 4-year maintenance cycle, bird species diversity would probably increase. Several forest species that might also use the ROW for foraging include the broad-winged hawk (*Buteo platypterus*) and ruffed grouse (*Bonasa umbellus*).

Confer and Pascoe (2003) found that ROWs in forested areas support high production of shrubland birds and do not exert a measurably harmful effect on forest-nesting birds. Selective herbicide application on the ROW sustained shrubland vegetation and supported high densities and high nesting success. Selective herbicide use (e.g., cut-stump treatments) encourages the development of shrub habitat without negatively impacting birds nesting in such habitats (Marshall and Vandruff 2002).

Potential impacts on waterfowl and shorebirds could primarily occur from impacts on habitat or changes in habitat. Construction could cause short-term changes in water quality from increases in siltation and sedimentation related to ground disturbance. The potential for such impacts would be lessened by conducting construction in wetlands in winter, as practicable, and by prohibiting activities with motorized equipment in moderate- and high-value waterfowl and wading bird habitats between April 15 and July 15 to minimize the potential disruption of avian breeding and nesting activities (Section 2.4). Long-term impacts could result from habitat alterations (i.e., changing forested wetlands to scrub-shrub and emergent wetlands within the ROW). This could have a slight beneficial impact on most waterfowl and shorebird species.

The acreages of waterfowl and wading bird habitats located within the ROWs for the alternative routes are provided in Table 3.5-5. The transmission line would have only a minor impact on waterfowl and wading bird habitats since the preferred habitat for most species (e.g., emergent wetlands, ponds, and lakes) would not be affected by the proposed project (Table D-2, Appendix D). However, the potential for waterfowl and wading birds to collide with the transmission line could be assumed to be related to the extent of preferred habitats crossed by the line and the extent of other waterfowl and wading bird habitats within the immediate area.

Meyer and Lee (1981) concluded that, while waterfowl (in Oregon and Washington) were especially susceptible to colliding with transmission lines, no adverse population or ecological results occurred because all the species affected were common and because collisions occurred in less than 1% of all flight observations. A similar conclusion was reached by Stout and Cornwell (1976), who suggested that less than 0.1% of all nonhunting waterfowl mortality nationwide was due to collisions with transmission lines. An informal study of a wetland near the Orrington Substation revealed no waterfowl mortality over several years, despite the fact that this wetland is crossed by 18 transmission lines (DOE 1995).

A few studies have examined the potential for collisions by raptors with transmission conductors and support wires. During 1 year of examination of the foraging activities of raptors in a New Hampshire ROW corridor, Denoncour and Olson (1984) did not find any mortality of hawks. Raptors have several attributes that decrease their susceptibility to collisions with transmission lines: (1) they have keen eyesight; (2) they soar or use relatively slow flapping flight; (3) they are generally maneuverable while in flight; (4) they learn to use utility poles and structures as hunting perches or nest sites and become conditioned to the presence of lines; and (5) they do not fly in groups (like waterfowl), so their position and altitude are not determined by other birds. Therefore, raptors are not likely to collide with transmission lines unless distracted (e.g., while pursuing prey) or when other environmental factors (e.g., weather) contribute to increased susceptibility (Olendorff and Lehman 1986).

The shield wire is often implicated as the primary culprit in bird losses involving higher voltage lines because birds fly over the more visible conductor bundles only to collide with the relatively invisible, thin shield wire (Faanes 1987; Thompson 1978). Young inexperienced birds, as well as migrants in unfamiliar terrain, appear to be more vulnerable to wire strikes than resident breeders. Also, many species appear to be most highly susceptible to collisions when alarmed, pursued, searching for food while flying, engaged in courtship, taking off, landing, when otherwise preoccupied and not paying attention to where they are going, and during night and inclement weather (Thompson 1978).

Some mortality resulting from bird collisions with the transmission lines is considered unavoidable. However, anticipated mortality levels are not expected to result in long-term loss of population viability in any individual species or lead to a trend toward listing as a rare or endangered species, because mortality levels are anticipated to be low and spread over the life of the transmission line. A variety of mitigation measures, such as those outlined in *Avian Protection Plan (APP) Guidelines* (APLIC and USFWS 2005), would minimize impacts to birds. The applicant plans to use marker balls and/or flappers to reduce potential bird collisions with the NRI (Section 2.4.4). Table 4.5-2 lists the stream crossings where ball markers would be installed. Brown and Drewien (1995) summarized other studies that showed that markers reduced bird collision mortality by 28 to 89%.

There would be no impact on raptors from electrocution when landing on the structures because the spacing between the conductors and ground wire on top of the structures would exceed the wing span of the bald eagle (the largest raptor likely to occur in the area of the alternative routes).

Active osprey nests are often observed on support structures of the existing 345-kV transmission line. New support structures associated with the proposed project that would be

TABLE 4.5-2 Water Body Crossings Where Ball Markers Would Be Used to Mitigate Potential Bird Collisions

	Water Body Crossing				
Alternative Route	Penobscot River	Great Works Stream	Narraguagus River	Machias River	St. Croix River
Modified Consolidated Corridors	–[a]	X	X	X	X
Consolidated Corridors	–	–	X	X	X
Previously Permitted	–	X	X	X	X
MEPCO South	X (2 crossings)	–	–	–	X

[a] A dash indicates that the route does not cross the water body.

Sources: BHE (2005); Paquette (2005cc).

located near larger streams, such as the Narraguagus River, would become candidate sites for osprey nests. The applicant has mitigation measures in place should osprey nests become a hazard to the birds or to safe operation of the transmission line (Section 2.4.4).

4.5.2.1.5 Potential Impacts on Amphibians and Reptiles. Amphibians and reptiles could be affected by habitat loss or alteration and by encounters with construction equipment. Overall, most amphibian and reptile species that range within the study area would either (1) not be affected by the proposed project, or (2) experience only minor beneficial or detrimental impacts (Table D-3, Appendix D). Those species most likely to be adversely affected by forest removal are the wood frog (*Rana sylvatica*) and northern ringneck snake (*Diadophis punctatus edwardsi*). A species most likely to benefit from the establishment of a ROW is the eastern smooth green snake (*Opheodrys v. vernalis*).

4.5.2.1.6 Potential Impacts on Aquatic Resources. Installation of support structures near water bodies and clearing of the transmission line ROW would be the principal potential sources of project impacts on aquatic biota. Potential impacts could include changes in water surface flow patterns, deposition of sediment in surface water bodies, changes in water quality or temperature regimes, loss of riparian vegetation, and changes in human access to water bodies. The severity of impacts would depend upon such factors as season of construction, stream size, corridor width to be cleared, construction procedures, and quality of the existing habitat.

Turbidity and sedimentation from erosion are part of the natural cycle of physical processes in water bodies, and most fish populations have adapted to short-term changes in these parameters. However, if sediment loads are unusually high or last for extended periods of time, adverse impacts can occur. Increased sediment can decrease fish feeding efficiency, levels of invertebrate prey, and fish spawning success. Deposition of fine sediment onto spawning gravels can adversely affect the survival of incubating fish eggs, alevin (a trout or salmon hatched out of its egg, but still attached to its yolk sac), and fry.

All alternative routes would cross coldwater fish streams (e.g., brook trout streams) in addition to those that are Atlantic salmon DPS and/or EFH or shortnose sturgeon water bodies. Information on the Atlantic salmon streams for each alternative route is summarized in Table 3.5-8, and an EFH assessment for the Atlantic salmon is provided in Appendix G. The MEPCO South Route would cross shortnose sturgeon habitat (the Penobscot River) twice. Potential impacts on fishes and other aquatic biota would be negligible because of mitigation measures that the applicant would undertake to minimize erosion and streamside disturbances, as well as to maintain stream shading (Sections 2.4.1 through 2.4.3).

In general, stream temperature alteration is reported to be one of the most significant impacts from clearing of riparian vegetation. For a stream to support coldwater species, such as brook trout, the water temperature should not exceed about 68ºF (20ºC) for more than short periods of time or distances. Removal of tall trees from stream banks can increase exposure of the stream to the sun, which can increase water temperature. Coldwater species may avoid such areas. The normal reaction of fish exposed to stressful temperatures is to move along the temperature gradient until preferred temperatures are encountered. Fish could avoid elevated temperatures by swimming upstream or downstream to areas of groundwater inflow, to deep holes, or to shaded areas.

Only a short linear width of riparian vegetation at any stream crossing (e.g., 100 to 170 ft [30 to 52 m], plus topping or removal of adjacent danger trees) would require clearing for the transmission line. Thermal conditions of larger streams would be generally unaltered regardless of ROW exposure, since they are mostly unshaded. Therefore, stream-warming impacts on any of the larger streams (e.g., 10 ft [3 m] wide or wider) crossed by any of the alternative routes would not be expected. Nevertheless, some thinning of trees would be required at several narrower streams that do have a shading canopy. As a result, those streams could experience some degree of localized stream warming. These streams would likely be affected for 1 to 2 years until overhanging vegetation, shrubs, or alders become established along their banks.

To minimize the potential for stream warming or siltation and sedimentation that could result from bank disturbance, the applicant would adhere to the standard mitigation practices listed in its erosion and sedimentation control plan (TRC 2005a) and post-construction vegetation maintenance plan (TRC 2005b). These mitigation measures are summarized in Sections 2.4.1 and 2.4.2.

During operation of the transmission line, aquatic systems may be adversely affected by maintenance activities, primarily vegetation control. However, vegetation control near stream crossings would be infrequent (occurring no more often than once every 3 to 4 years) and at a much lower activity level than would occur during construction. Only selected trees might have to be removed or trimmed. Control of vegetation within streamside buffer zones would be accomplished by manual techniques. Therefore, erosion of stream banks from maintenance activities would be expected to be negligible. Accidental release of toxicants (e.g., gasoline, lubricants, and herbicides) would not be expected because heavy machinery would not be used near streams, and no herbicides would be used within the 75-ft (23-m) stream buffer zones (Section 2.4.5).

Among the herbicides that the applicant is considering (Paquette 2005a), fosamine and imazapyr are considered practically nontoxic to fish, while glyphosate (formulations for terrestrial uses) is considered slightly toxic to freshwater invertebrates and moderately toxic to fish (BPA 2000). Thompson et al. (2004) and Wojtaszek et al. (2004) found that aerial applications of glyphosate do not pose a significant risk of acute effects or growth effects to larval stages of amphibians in forest wetland environments. Studies summarized by Wojtaszek et al. (2004) indicate that terrestrial or aquatic uses of glyphosate pose minimal risks to aquatic organisms. Therefore, potential impacts from selected land application of herbicides for NRI maintenance would be even more protective of aquatic and wetland biota, since there would be no herbicide application within aquatic habitats (Section 2.4.5).

Indirect impacts on fisheries can occur from increased public access via the ROW. Fisheries could be impacted by increased fishing pressure or by human activity (ATV use), which could disturb vegetation and soils and thus cause erosion and related stream impacts (Galvin 1979). However, this should be a minor impact where the ROW would be co-located with roads or existing ROWs, or where they would be located close to logging trails that already provide stream access. Nevertheless, construction of the proposed route would add additional access points to many of the streams that the line would cross, regardless of the alternative route.

No impacts on aquatic resources would be created from the installation of AC mitigation, since in-stream activities are not anticipated as part of the mitigation action (Paquette 2005ee).

4.5.2.1.7 Potential Impacts on Wetlands. Appendix E presents a wetland and floodplain assessment for the proposed project. The following summarizes the potential impacts on wetlands that could occur from the proposed project.

Potential impacts on wetlands resulting from construction and maintenance of the proposed transmission line include (1) alteration of hydrology (Section 4.4); (2) alteration of vegetative community structure; (3) disruption of soils (Section 4.2); and (4) subsequent reduction or modification in wetland functions, including those related to the maintenance of water quality, ecosystem support (e.g., nutrient cycling and primary production), wildlife habitat, and species diversity.

Although wetland areas would be avoided to the maximum extent possible, not all such areas could be avoided. Thirty-four support structures would be located within wetlands for the Modified Consolidated Corridors Route (Paquette 2005s). The number of support structures that could be located within wetlands for the other alternative routes (Table 4.5-3) was based on the number of structures required for the alternative and the percentage of the route length that is composed of wetlands. This would present a conservative estimate of the number of structures within wetlands. The actual number of structures would probably be less, as adjustments could be made during the final micrositing process.

The most significant impact on wetlands would occur in areas when forested wetlands were cleared and subsequently converted to scrub-shrub or emergent wetlands (Table 4.5-3). The least modification to forested wetlands would occur for those located adjacent to streams, because within the 75-ft (23-m) stream buffer zones, only the portion of the trees that would infringe upon the conductor clearance zone would generally be cut. Maximum retention of woody vegetation and minimal on-ground disturbance would occur in these areas in order to protect stream integrity (Section 2.4.2). A very small total amount of wetland fill would also be required for support structure poles (Table 4.5-3). A number of wetlands of special significance (Section 3.5.3) would also be located within the ROWs of the alternative routes. No adverse functional changes in wetland functions would be anticipated for any of the alternative routes.

Mitigation measures are in place that would restrict the distance from wetlands within which herbicide application would be allowed (Section 2.4.5). Furthermore, there is a very low probability of wetland contamination by the herbicides because of their restricted movement through soil (American Cyanamid Company 1988; Monsanto Company 1995; BPA 2000). Thus, no impacts on wetlands from herbicide use would be expected for any alternative route.

TABLE 4.5-3 Impacts of the NRI on Wetlands

	Alternative Route[a]			
Parameter	MCCR	CCR	PPR	MSR
Forested wetland converted to scrub-shrub wetland (acres)[b]	70	53	103	73
Number of support structures in wetlands	34	29	36	51
Number of poles in wetlands	73	62	77	109
Wetland area filled by support structure poles (acre)	0.03	0.02	0.03	0.04

[a] CCR = Consolidated Corridors Route, MCCR = Modified Consolidated Corridors Route, MSR = MEPCO South Route, PPR = Previously Permitted Route.

[b] To convert acres to hectares, multiply by 0.405.

Sources: BHE (2004); Paquette (2005j,s,t).

4.5.2.1.8 Potential Impacts on Special Status Species. This section evaluates the potential impacts on special status species, including Federally and State listed threatened and endangered species and species considered of special concern in Maine (Table D-4, Appendix D). While many of the special status species listed in Table D-4, Appendix D, were historically collected from the project area or have ranges that encompass a portion of one or more of the alternative routes, many of these species are not expected to be present within the ROWs of the alternative routes. For those special status species that might be present, impacts would be similar to those previously discussed for other vegetation, wildlife, and aquatic biota. Because the distribution and/or abundance of special status species are limited, any impact could affect the viability and survival of these species in the area.

Habitat availability is a primary limiting factor for some of the special status species (Table D-4, Appendix D). Therefore, habitat alteration related to project construction and subsequent ROW maintenance could contribute to the decline of some species (e.g., those preferring forested habitats) or to an increase in others (e.g., those preferring shrublands and fields). Table 4.5-4 presents the potential impacts on special status species resulting from the establishment and maintenance of the ROW for each alternative route. Potential adverse impacts from construction and maintenance of the ROW would be minimized or avoided by the implementation of appropriate mitigative measures (Sections 2.4.2 and 2.4.5).

DOE initiated informal consultation with the USFWS and NOAA Fisheries requesting information on species protected under the ESA, and both agencies are cooperating in the preparation of the EIS (see Appendix A). Of particular concern to these regulatory agencies are potential impacts on the Atlantic salmon and the bald eagle. Impacts on these species are addressed in detail in the biological assessment (Appendix F) and, for the Atlantic salmon, the EFH assessment (Appendix G). All streams and rivers that would be crossed by the alternative routes are considered EFH. The potential for impacts on EFH would be greatest where forested

TABLE 4.5-4 Potential Impacts on Special Status Species from ROW Establishment

Species[a]	Alternative Route: Modified Consolidated Corridors	Consolidated Corridors	Previously Permitted (No Action)	MEPCO South
Plants				
Allegheny vine *Adlumia fungosa*	ROW construction could potentially alter or eliminate preferred habitat (e.g., wet woods).	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	No impact expected; no recent records within the potentially affected area.
Nantucket shadbush *Amelanchier nantucketensis*	ROW may provide suitable habitat (fields, edges, thickets).	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors
Swamp birch *Betula pumila*	Clearing during ROW construction could remove some individuals in forested wetlands.	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors
Swarthy sedge *Carex adusta*	ROW may provide suitable habitat (open areas).	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors
Bicknell's sedge *Carex bicknellii*	ROW may provide suitable habitat (fields, meadows).	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors
Orono sedge *Carex oronensis*	ROW may provide suitable habitat (fields, meadows, clearings).	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors
Dioecious sedge *Carex sterilis*	No impact expected; only historical records along route, preferred habitats (gravelly river shores, fens) would not be affected.	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors

TABLE 4.5-4 (Cont.)

	Alternative Route			
Species	Modified Consolidated Corridors	Consolidated Corridors	Previously Permitted (No Action)	MEPCO South
Sparse-flowered sedge *Carex tenuiflora*	ROW construction could potentially alter or eliminate habitat.	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors
Sheathed sedge *Carex vaginata*	No impact expected; white cedar swamps rare and could be avoided during construction.	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors
Wiegand sedge *Carex wiegandii*	ROW construction could potentially reduce habitat quality if trees near peatlands removed.	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors
Prickly hornwort *Ceratophyllum echinatum*	ROW may provide suitable habitat (still waters in nonforested areas).	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors
Northern wild comfrey *Cynoglossum virginianum*	ROW may provide suitable habitat (forested borders and openings).	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors
Awned sedge *Cyperus squarrosus* var. *boreale*	No impact expected; habitat (riverbanks and stream shores) would not be impacted and species unlikely to be encountered.	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	No impact expected; not known to occur within the potentially affected area.

TABLE 4.5-4 (Cont.)

	Alternative Route			
Species	Modified Consolidated Corridors	Consolidated Corridors	Previously Permitted (No Action)	MEPCO South
Ram's-head lady's-slipper *Cypripedium arietinum*	No impact expected, as only historical records from potentially affected area.	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors
Showy lady's-slipper *Cypripedium reginae*	Forest clearing, particularly in deer yards, could reduce or eliminate local populations.	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors
Hyssop-leaved fleabane *Erigeron hyssopifolius*	No impact expected; preferred habitat (river shores, rocky summits, outcrops) would not be impacted.	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors
Fall fimbry *Fimbristylis autumnalis*	No impact expected; preferred habitat (pond shores) would not be impacted.	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors
Bog bedstraw *Galium labradoricum*	No impact expected as species occurs in both forested and open habitats.	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors
Common mare's-tail *Hippuris vulgaris*	No impact expected; ROW would not cross lakes or affect any small ponds that may be crossed.	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors

TABLE 4.5-4 (Cont.)

	Alternative Route			
Species	Modified Consolidated Corridors	Consolidated Corridors	Previously Permitted (No Action)	MEPCO South
Long-leaved bluet *Houstonia longifolia*	No impact expected; preferred habitat (river shore ledges) would not be impacted.	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors
Alpine clubmoss *Huperzia selago*	ROW may provide suitable habitat (disturbed sites near water and coniferous woods).	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	No impact expected; not known to occur within the potentially affected area.
Vasey rush *Juncus vaseyi*	ROW may provide suitable habitat (various nonforested wetlands).	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors
American shore-grass *Littorella uniflora*	No impact expected; preferred habitat (shores and margins of lakes and ponds) would not be impacted.	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors
Swamp fly-honeysuckle *Lonicera oblongifolia*	No impact expected; preferred habitat (open areas of cedar swamps) would not be impacted.	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors
White adder's-mouth *Malaxis monophyllos* (= *brachypoda*)	ROW construction could potentially reduce bog habitat quality or quantity.	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors

TABLE 4.5-4 (Cont.)

	Alternative Route			
Species	Modified Consolidated Corridors	Consolidated Corridors	Previously Permitted (No Action)	MEPCO South
Smooth sandwort *Minuartia glabra*	No impact expected; preferred habitat (open granitic ledges of small mountains) would not be impacted.	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors
Canada mountain-ricegrass *Oryzopsis canadensis*	ROW construction could potentially alter or eliminate habitat (rocky woods).	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	No impact expected; not known to occur within the potentially affected area.
Alga-like pondweed *Potamogeton confervoides*	No impact expected; preferred habitat (ponds) would not be impacted.	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors
Indian grass *Sorghastrum nutans*	ROW may provide suitable habitat (prairies and wood borders).	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors
Water awlwort *Subularia aquatica*	No impact expected; preferred habitat (ponds and lakes) would not be impacted.	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors
Small purple bladderwort *Utricularia resupinata*	No impact expected; preferred habitat (pond, lake, and river shores) would not be impacted.	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors

TABLE 4.5-4 (Cont.)

	Alternative Route			
Species	Modified Consolidated Corridors	Consolidated Corridors	Previously Permitted (No Action)	MEPCO South
New England violet *Viola novae-angliae*	No impact expected; preferred habitat (slate ledges of Penobscot River) would not be impacted.	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors
Water stargrass *Zosterella dubia*	No impact expected; preferred habitat (quiet waters) would not be impacted.	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors
Invertebrates				
Yellow lampmussel *Lampsilis cariosa*	No impact expected; not known to occur within the potentially affected area.	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	No impact expected; preferred habitat (ponds, lakes, slow-moving sections of streams and rivers) would not be impacted.
Tidewater mucket *Leptodea ochracea*	No impact expected; does not occur within potentially affected areas.	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors
Pygmy snaketail *Ophiogomphus howei*	No impact expected; preferred habitat (medium to large unpolluted rivers) would not be impacted.	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors

TABLE 4.5-4 (Cont.)

Species	Alternative Route			
	Modified Consolidated Corridors	Consolidated Corridors	Previously Permitted (No Action)	MEPCO South
Tomah mayfly *Siphlonisca aerodromia*	No impact expected; not known to occur within the potentially affected area.	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	No impact expected; preferred habitat (sedge-dominated floodplains) would not be impacted by construction.
Fishes				
Shortnose sturgeon *Acipenser brevirostrum*	No impact; does not occur within potentially affected area.	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	No impact expected; Penobscot River would not be affected by the two transmission line crossings.
Atlantic salmon *Salmo salar*	No adverse impact expected because of mitigation required at stream crossings.	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors
Birds				
Upland sandpiper *Bartramia longicauda*	No impact expected; preferred habitat (large open grassy areas) would not be impacted.	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors
Sedge wren *Cistothorus platensis*	No impact expected; preferred habitat (wet meadows) would not be impacted.	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors

TABLE 4.5-4 (Cont.)

	Alternative Route			
Species	Modified Consolidated Corridors	Consolidated Corridors	Previously Permitted (No Action)	MEPCO South
Bald eagle *Haliaeetus leucocephalus*	No habitat impact expected; potential for individuals to collide with conductors or shield wires.	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors
Mammals				
Eastern timber wolf *Canis lupus lycaon*	No impact expected; potential to occur within the potentially affected area unlikely. Individuals could readily relocate away from impact areas.	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors
Eastern cougar *Felis concolor couguar*	No impact expected; possibility of impact occurring within the potentially affected area unlikely. Individuals could readily relocate away from impact areas.	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors	Same as Modified Consolidated Corridors

[a] See Table D-4 (Appendix D) for Federal or State listing status.

Sources: MDIFW (2003); MNAP (2002); NatureServe (2005).

riparian areas (both wetland and upland forests) within 150 ft (46 m) of EFH water bodies (Table 4.5-5) would be altered to scrub-shrub habitats in order to provide adequate conductor clearance: 82 acres (33 ha) for 57 streams crossed by the Modified Consolidated Corridors Route; 89 acres (36 ha) for 59 streams crossed by the Consolidated Corridors Route; 92 acres (37 ha) for 59 streams crossed by the Previously Permitted Route; and 65 acres (26 ha) for 55 streams crossed by the MEPCO South Route. Among these totals, no Atlantic salmon DPS water bodies would be crossed by the MEPCO South Route. Potential impacts on these water bodies would be negligible because of mitigation that would be employed to minimize erosion, protect stream banks, and maintain stream shading (Sections 2.4.1, 2.4.2, and 2.4.5). More detailed assessments of potential impacts on Atlantic salmon are presented in the biological assessment (Appendix F) and EFH assessment (Appendix G).

Among the alternative ROWs, only one essential bald eagle habitat (i.e., nest site) occurs within the MEPCO South Route. However, bald eagle nests occur within most municipalities that the alternative routes would traverse. Mitigative measures (e.g., construction timing and route avoidance) would be taken near essential eagle habitats. Bald eagles could potentially collide with the transmission lines. The potential would be the same for all four routes for the St. Croix River crossing. The MEPCO South Route would cross the Penobscot River at two locations, which would present a further potential for bald eagles to be affected by that alternative. For the other alternative routes, the crossings of the Great Works Stream (Modified Consolidated Corridors and Previously Permitted Routes only), Narraguagus River, and Machias River would be potential locations where bald eagles could be impacted by the transmission line. Placing marker balls on the shield wires over these streams would minimize impact potential (Section 4.5.2.1.4).

Overall, construction and operation of the proposed project are not likely to adversely affect bald eagles. A biological assessment for the bald eagle is presented in Appendix F.

TABLE 4.5-5 Impacts of the NRI on Forested Riparian Areas of Essential Fish Habitat Water Bodies

	Alternative Route[a]			
Parameter	MCCR	CCR	PPR	MSR
Forested land converted to scrub-shrub land (acres)[b,c]	82	89	92	65
Number of water bodies	57	59	59	55

[a] CCR = Consolidated Corridors Route, MCCR = Modified Consolidated Corridors Route, MSR = MEPCO South Route, PPR = Previously Permitted Route.

[b] Includes wetland and upland forests within 150 ft (46 m) of EFH water bodies.

[c] To convert acres to hectares, multiply by 0.405.

Source: Paquette (2005j).

4.5.2.2 Rescission of the Presidential Permit

Under the Rescission of the Presidential Permit Alternative, BHE would not build the NRI. Therefore, there would be no impacts on ecological resources beyond those already occurring.

4.6 CULTURAL RESOURCES

4.6.1 Methodology

Potential impacts on cultural resources (archaeological sites, historic structures and features, and traditional cultural properties) were evaluated on the basis of previous survey results from the project area, the potential of the area to contain sites, the presence of recorded sites, the significance evaluations of known sites (determinations of eligibility for listing on the NRHP), and levels of previous disturbance (see Section 3.6). Impacting factors for the NRI project that could affect cultural resources include ROW clearance and support structure installation; access road construction; staging area upgrades; expansion of substation areas; and the addition of AC mitigation, as required, to the existing M&N gas pipeline.

4.6.2 Potential Impacts

4.6.2.1 Alternative Routes

4.6.2.1.1 Right-of-Way Clearance and Support Structure Installation. No impacts on cultural resources are anticipated from the construction of the Modified Consolidated Corridors Route. The Maine SHPO has approved the archaeological survey conducted for this route and has concurred that the Modified Consolidated Corridors Route would not adversely affect cultural resources (Shettleworth 2005). One significant historic property was recorded during the survey, and the route was modified to avoid impacting the site. This strategy was acceptable to the SHPO (Shettleworth 2005). However, should archaeological remains be unexpectedly uncovered during any ground-disturbing activities resulting from the proposed project (e.g., along the corridor, within staging areas, during substation expansion), work would be stopped immediately in the vicinity of the find, and the SHPO and a qualified archaeologist contacted to determine its significance. No historic structures have been identified within the project area or within viewing distance of the transmission line corridor. No traditional cultural properties have been identified within the project area under this alternative.

Impacts on cultural resources are possible from construction of the Consolidated Corridors Route, although they are unlikely since this alternative primarily would be the same as the Modified Consolidated Corridors Route and no impacts are anticipated along that route. The areas where the two routes diverge (between Blackman Stream and the Pickerel Pond area

[Figure 2.1-4] and near Myra Camps [Figure 2.1-5]) have not been surveyed along the Consolidated Corridors Route and could contain archaeological remains. If this alternative route is chosen, a cultural resource survey would need to be conducted in these two areas and the results approved by the Maine SHPO. Any sites recorded during the survey would need to be evaluated for significance, and impacts on sites determined to be significant would need to be avoided or mitigated. No historic structures have been identified within the project area or within viewing distance of the transmission line corridor. No traditional cultural properties have been identified within the project area for this alternative.

Impacts on cultural resources from construction of the Previously Permitted Route are possible but unlikely. Much of this route was previously surveyed in 1989 and additional portions were surveyed for the M&N pipeline in 1999 (see Section 3.6). If this alternative route is chosen, a cultural resource survey would need to be conducted in any areas not previously surveyed and the results approved by the Maine SHPO. Any sites recorded during the survey would need to be evaluated for significance, and impacts on sites determined to be significant would need to be avoided or mitigated. No historic structures have been identified within the project area or within viewing distance of the transmission line corridor. No traditional cultural properties have been identified within the project area under this alternative.

Impacts on cultural resources from construction of the MEPCO South Route are possible. Although the corridor has not been surveyed, the area along the Penobscot River has been identified as an area of high potential for containing significant archaeological material (Dana 2003). While no traditional cultural properties have been identified within the project area under this alternative, concern was raised over possible impacts on archaeological sites by the Penobscot Indian Nation and the Passamaquoddy Indian Tribe (BHE 2005). If this alternative route is chosen, a cultural resource survey would need to be conducted and the results approved by the Maine SHPO and the Tribes. Any sites recorded during the survey would need to be evaluated for significance, and impacts on sites determined to be significant would need to be avoided or mitigated. One historic site has been identified within the project area or within viewing distance of the transmission line corridor (Paquette 2005j). If this alternative route is selected, this site would need to be evaluated for significance and possible impacts on the site. If the site were to be determined significant, specific impacts would need to be identified and mitigated.

4.6.2.1.2 Access Road Construction. No new permanent access roads would be needed for any of the alternative routes. However, new temporary access would be required for two of the alternative routes. As stated in Chapter 2, about 21 acres (8.5 ha) of temporary access roads would be needed for the Previously Permitted Route, and more than 32 acres (13 ha) would be needed for the MEPCO South Route. These areas would likely require surveys before the new temporary access roads are developed. Sites recorded during surveys would need to be evaluated for significance, and impacts on sites determined to be significant would need to be avoided or mitigated.

4.6.2.1.3 Substation Alterations. For all of the alternative routes, four substations require modification. Modifications to two of the substations would be completed within the current fenced area, and no additional land disturbance would be required. The other two substations, however, would require expansion outside the current fenced area. The Orrington Substation would require a 0.8-acre (0.3-ha) expansion, while the Kimball Road Substation would require a 0.2-acre (0.08-ha) expansion. Depending on the extent of disturbance already present near these two substations, a cultural survey may be necessary before any modifications occur outside the fenced areas.

4.6.2.1.4 Staging Areas Construction. All five staging areas that would be used for the Modified Consolidated Corridors, Consolidated Corridors, and Previously Permitted Routes were previously cleared and disturbed and have been previously surveyed.

Five staging areas would also be used for the MEPCO South Route (Section 2.3.4.5). These include the Route 178 and Costigan Mill staging areas that would also be used for the other three alternative routes.

The Costigan Mill staging area is located on an industrial site that was previously filled, graded, and partially paved; thus, it is sufficiently disturbed such that it would not likely contain intact archaeological deposits. A high level of previous disturbance is not indicated at the other staging areas. The Chester staging area, used only for the MEPCO South Route, could contain archaeological material because of its location near the Penobscot River. This staging area could require an additional survey for cultural resources unless proof of previous ground disturbance can be obtained.

4.6.2.1.5 AC Mitigation. As required, the installation of AC mitigation for the M&N gas pipeline would take place within the existing pipeline corridor, an area that has been previously disturbed. Therefore, no impacts to cultural resources are expected for any of the alternative routes.

4.6.2.2 Rescission of the Presidential Permit

Under the Rescission of the Presidential Permit Alternative, BHE would not build the NRI. Therefore, there would be no impacts on cultural resources beyond those already occurring.

4.7 SOCIOECONOMICS

This section discusses the potential effects of the proposed project on the existing socioeconomic environment for the ROI consisting of Hancock, Penobscot, and Washington Counties.

4.7.1 Methodology

Potential direct socioeconomic impacts for the proposed project were evaluated by using data provided by BHE (Paquette 2005i) on on-site construction employment, employee residential locations, and cost and schedule. Cost data included detailed labor expenditures in the various occupational categories and materials and equipment costs required for construction of the transmission line along the alternative routes. Expenditures for AC mitigation equipment associated with the M&N gas pipeline are also included. In addition to direct (on-site) impacts of project construction and operation, there may also be indirect impacts in the ROI associated with wage and salary expenditures and material procurement. To calculate potential indirect impacts, construction workforce and materials expenditure data for each alternative route were used in conjunction with IMPLAN® input-output regional data (MIG, Inc. 2005) for the ROI. IMPLAN is an input-output-based modeling tool that estimates employment and income multipliers for those sectors in the ROI in which NRI labor and material expenditures would occur.

Socioeconomic impacts were evaluated for population, employment and income, and housing. Given the similarities in the locations of the Modified Consolidated Corridors, Consolidated Corridors, and Previously Permitted Routes, these impacts are presented together in the following sections.

4.7.2 Potential Impacts

4.7.2.1 Alternative Routes

Because of their specialized skills, at least two-thirds of the direct workers required to build the NRI, particularly linemen and crew supervisory staff, were assumed to temporarily move into the ROI for each of the alternative routes (Paquette 2005s). Similarly, only a small number of project-related engineering and construction management staff were assumed to be located in the ROI during the construction period. Given the relatively short duration of various construction activities (Section 2.3.7), it was assumed that the majority of these workers would only reside in the ROI for between 4 and 7 months (Paquette 2005i,hh), making it unlikely that relocated workers would be accompanied by their families. Impacts of the project on population would, therefore, be minimal. Minor impacts are expected to occur on local housing markets as it was assumed that only half of the in-migrating workers would occupy local rental housing that is already vacant, and half would occupy hotels and motels. With only a small number of temporary in-migrants, impacts on local public services, including police and fire protection, educational and other local government services, and health and medical resources, would be minimal and well within the capacity of the existing local community infrastructure. Because no new jobs and income would be created in the ROI to operate or maintain the transmission line, there would be no in-migration or population impacts expected during the operational lifetime of the project.

Construction of the NRI would create a small amount of additional indirect economic employment and income in the ROI. These impacts are largely associated with direct labor expenditures required for the project, with a large proportion of engineering and construction management labor expenditures, expenditures associated with ROW easements, and expenditures on materials used to build the line (e.g., support structures, conductors, and shield wires) occurring outside the ROI. No additional employment or income would be generated from line operations.

Construction of the NRI along the Modified Consolidated Corridors, Consolidated Corridors, and Previously Permitted (No Action) Routes would use between 1,391 and 1,461 acres (563 and 591 ha) of forested land, and 1,513 acres (612 ha) would be used for the MEPCO South Route. Although the majority of this land within the alternative ROWs is currently commercial timberland, given that nearly 4.3 million acres (1.7 million ha) of the three counties are considered timberlands (Table 3.5-2), the removal of this land is not expected to impact logging employment and income, or local employment and income in the ROI.

Socioeconomic impacts for the Modified Consolidated Corridors, Consolidated Corridors, and Previously Permitted (No Action) Routes would be almost identical (Table 4.7-1). Construction of a line along any of these routes would create 120 direct jobs, and wage and salary expenditure and material procurement expenditures would produce an additional 110 indirect jobs in the ROI. Construction along any of these routes would produce about $4.7 million in direct income and an additional $3.1 million in indirect income in the ROI. Construction activities would impact the ROI employment growth rate for 2006 by no more than 0.01 percentage point.

Socioeconomic impacts for the MEPCO South Route are also presented in Table 4.7-1. Construction of the MEPCO South Route would create 150 direct jobs, and wage and salary expenditure and material procurement would produce an additional 130 indirect jobs in the ROI. Construction along the MEPCO South Route would produce $5.8 million in direct income and an additional $3.5 million in indirect income in the ROI. Construction activities on the MEPCO South Route would impact the ROI employment growth rate for 2006 by more no than 0.01 percentage point.

4.7.2.2 Rescission of the Presidential Permit

Under the Rescission of the Presidential Permit Alternative, BHE would not build the NRI. Therefore, there would be no socioeconomic impacts beyond those already occurring.

4.8 ENVIRONMENTAL JUSTICE CONSIDERATIONS

4.8.1 Methodology

The analysis considers impacts on all resource areas associated with the proposed transmission line construction and operation. If high and adverse impacts on the general

TABLE 4.7-1 Economic Impacts Related to the Alternative Transmission Line Routes in 2006

Parameter	Modified Consolidated Corridors, Consolidated Corridors, and Previously Permitted Routes (No Action)	MEPCO South Route
Construction		
Jobs (number)		
Direct	100	140
Total	190	250
Labor income ($ millions 2005)		
Direct	3.8	5.2
Total	6.4	8.4
AC mitigation		
Jobs (number)		
Direct	20	10
Total	40	30
Labor income ($ millions 2005)		
Direct	0.9	0.6
Total	1.4	0.9
Total (construction plus AC mitigation)		
Jobs (number)		
Direct	120	150
Total	230	280
Labor income ($ millions 2005)		
Direct	4.7	5.8
Total	7.8	9.3

Sources: Paquette (2005i,gg,ll,mm).

population are identified for a particular resource area, disproportionality would be determined by comparing the location of the high and adverse impacts with the location of minority and low-income populations. Specifically, there would be disproportionate impacts on the minority or low-income populations if any high and adverse impacts occurred in any census block group where the minority or low-income populations exceeded 50% of the total population in the block group, or where the minority or low-income populations exceeded the state minority or low-income average by more than 20 percentage points.

If, however, analyses in each resource area determine that impacts on the general population are not adverse as a result of the proposed action and alternatives, it can be concluded that no disproportionately high and adverse impacts on minority and low-income populations would occur, regardless of the location of those populations.

Minority and low-income populations located in proximity to the NRI could potentially be affected during transmission line construction, operation, and maintenance, specifically by (1) noise, dust, and equipment emissions during construction, and (2) as electromagnetic field (EMF) effects during operations. In order to include the areas in which these impacts might occur, the analysis of environmental justice impacts considered the potential for impacts within a 2-mi (3.2-km) zone along each alternative route. Given the similarities in the routes that would be taken by the Modified Consolidated Corridors, Consolidated Corridors, and Previously Permitted (No Action) Routes, these impacts are presented together when discussing potential impacts.

4.8.2 Potential Impacts

4.8.2.1 Alternative Routes

One single census block group, located along the western edge of the 2-mi (3.2-km) zone along the MEPCO South Route, includes the Passamaquoddy Indian Reservation and has a minority population that exceeds 50% of the total census block group population (Figure 3.8-1). Only a small portion (about 4 acres [1.6 ha]) of the 2-mi (3.2-km) zone is located within the Reservation. The following section describes the potential environmental effects of the proposed project in terms of any special circumstances or mechanisms through which low-income or minority populations may experience disproportionately high and adverse human health or environmental effects.

Potential impacts on minority or low-income populations of the MEPCO South Route within the single census block group include noise, dust, and vehicle emissions during construction. Although there are no residences or other buildings used by the public situated in that portion of the census block group located in the 2-mi (3.2-km) zone, temporary accommodation might be located in the area for recreation or subsistence activities. Project construction activities could potentially disrupt recreation and subsistence in this area, while noise and dust emissions during construction could potentially produce harmful human health effects that would disproportionately affect minority and low-income populations in this area. Noise, dust, and vehicle emissions during construction, however, are not expected to be high under any circumstances. Standard mitigation practices used to control emissions would reduce these to negligible amounts.

EMF effects occurring during project operation along the MEPCO South Route are another impact that might potentially affect minority or low-income populations in the single census block group. Although temporary accommodation used for recreation or subsistence activities might be located in that portion of the census block group located in the 2-mi (3.2-km) zone where elevated exposure to EMFs may occur, there are no residences or other buildings used by the public in this area. EMF impacts are therefore expected to be low.

Within the single census block group located in the Passamaquoddy Indian Reservation, visual impacts of the NRI are likely to be low. This is because visual resources in the area are of low quality, there are no key observation points located in the area, and visitation rates are low; therefore, viewer sensitivity to any changes in scenic quality as a result of the construction of the NRI would be low.

Even though there are potential adverse impacts of NRI construction or operation of the MEPCO South Route in the single census block group, given that these impacts are low, none of these impacts would disproportionately affect low-income or minority populations.

No census block group along any of the other alternative routes has a minority or low-income population that exceeds 50% of the total block group population, or that exceeds the state minority or low-income average by 20 percentage points. There are, therefore, no impacts of NRI construction or operation that would disproportionately affect low-income or minority populations for any of the alternative routes. Thus, there would be no disproportionately high and adverse impacts on minority or low-income populations.

4.8.2.2 Recission of the Presidential Permit

Under the Rescission of the Presidential Permit Alternative, BHE would not build the NRI. Therefore, there would be no impacts on environmental justice consideration beyond those already occurring.

4.9 VISUAL RESOURCES

This section evaluates the potential impacts of the alternative routes on visual resources.

4.9.1 Methodology

The potential for impacts on visual resources was evaluated by using the following evaluation criteria as provided in *Assessing and Mitigating Impacts to Scenic and Aesthetic Uses* (MDEP 2003)[1] to assess the impact of the proposed project within the viewshed of a scenic resource along each alternative route:

- *Landscape compatibility*. The extent to which the proposed activity would differ significantly from existing surroundings in terms of color, form, line, and texture;

- *Scale contrast.* The size and scope of the project at a given location; and

1 Many of the terms and evaluation procedures used in that publication are based on the Bureau of Land Management (BLM) Visual Resource Management (VRM) system guidelines (BLM 1986a,b).

- *Spatial dominance.* The degree to which the project would dominate the composition of the landscape, landforms, water, or sky in a particular landscape.

On the basis of these criteria, viewer expectation is an important aspect of the evaluation of visual impacts. Generally, visibility impacts from roadways are not considered to be as sensitive as views from recreational use areas or residences. The duration and role of specific views to individuals is critical to evaluating and interpreting the significance of potential impacts.

To evaluate the impacts of the alternative routes on road users, data from key observation points established along the routes were used (Section 3.9). These points were located in the foreground-middleground zone established for each route, which is the area between the viewer and a distance of 3 to 5 mi (5 to 8 km). Figures H-1 through H-16 (Appendix H) are photographs and photosimulations at key observation points for the Modified Consolidated Corridors, Consolidated Corridors, and Previously Permitted (No Action) Routes, while Figures H-1 through H-6 and H-15 through H-32 (Appendix H) are those for the MEPCO South Route. The photographs show the current visual environment at these points, while the photosimulations show artistic renderings of the addition of the NRI at these points.

Given the similarities in the corridor within which the Modified Consolidated Corridors, Consolidated Corridors, and Previously Permitted Routes would be located (Figure 2.1-1), the potential impacts for these three alternative routes are presented together in the following discussion.

4.9.2 Potential Impacts

4.9.2.1 Alternative Routes

A transmission line constructed along any of the alternative routes would affect the visual environment, although the significance of the impact for each route would vary depending on the location at which the transmission line would be viewed and the surrounding environmental setting. Both ends of the Modified Consolidated Corridors, Consolidated Corridors, and Previously Permitted (No Action) Routes, and numerous portions of the MEPCO South Route, would be located in semiurban and agricultural settings. At the western end of these routes, each line would also be adjacent to an existing transmission line. Although the line along these portions of each route would be located close to the viewing population, the presence of other structures and economic activity, and, in particular, the existing line, would mean that the proposed line would not be incompatible with, create any significant additional contrast with, or generally dominate the present landscape.

For the majority of their lengths, the Modified Consolidated Corridors, Consolidated Corridors, and Previously Permitted (No Action) Routes would pass through commercial forest lands that contain various recreational use areas and would be adjacent to Stud Mill Road, which is used by recreationists and also used as an access road for logging activities. Because of the mixed use of the land in the area of the alternative routes and because of the presence of Stud Mill Road and the adjacent ROW for the M&N gas pipeline, the transmission line would be only moderately incompatible with, or contrast with, the landscape within the foreground-middleground zone, although it would dominate the landscape in certain locations where the routes cross ridgelines and areas of open water and wetlands.

A transmission line along any alternative route would be moderately incompatible, mildly contrasting, and, occasionally, a dominant feature of the landscape. However, the line would largely be constructed with wooden H-frame structures, which would reduce the impact of the line on the visual environment. Natural light and background landscape elements would be visible around the structures, and given their construction type, the visual impression of the support structures would also lessen considerably with distance from the line.

Between the Orrington Substation and Great Works Stream, the NRI would be located adjacent to one or more existing transmission lines. The photographs and photosimulations illustrate that the addition of the NRI would generally not be a prominent addition to the visual landscape (Figures H-1 through H-3, Appendix H). Because of the proximity of the line to the existing transmission lines, views seen by road users from key observation points on either side of the transmission corridor would not be likely to differ substantially among alternative routes. However, the location of the routes is close to a number of residences in the corridor; thus, the line would be a dominant aspect of the landscape in these locations. The similarity in the heights of the forest cover and the support structures would reduce any incompatibility with, contrast with, or dominance over the visual landscape by the line.

The Pickerel Pond Reroute, which is the major difference between the Modified Consolidated Corridors and Consolidated Corridors Routes (Figure 2.1-4), was selected in part to avoid visual impacts. The Modified Consolidated Corridors Route would avoid potential visual impacts at the Sunkhaze Meadows National Wildlife Refuge and the Pickerel Pond Youth Conservation Center, which promotes fishing, hunting, and conservation (Sloan 2005a). The Consolidated Corridors Route would be adjacent to the southeastern and eastern border of Sunkhaze Meadow National Wildlife Refuge and would be near Pickerel Pond (Figure 2.1-2). Therefore, the Consolidated Corridors Route would pose a potential visual impact.

Potential visual impacts of concern include viewshed disturbances along Outstanding River Segments. Both the Narraguagus and Machias Rivers have Outstanding River Segments that could be adversely affected by all but the MEPCO South Route (which crosses no Outstanding River Segments). Figures H-11 and H-12 (Appendix H) illustrate the impact of the addition of the NRI at the Machias River crossing. The applicant has mitigation plans in place to minimize viewshed disturbances for these two Outstanding River Segments by locating the support structures farther away from the rivers than they otherwise would be located (Section 2.4.5).

For the Modified Consolidated Corridors, Consolidated Corridors, and Previously Permitted (No Action) Routes between Great Works Stream and the eastern end of Stud Mill Road at Route 1, the photographs and photosimulations (Figures H-7 through H-14, Appendix H) illustrate that the addition of a transmission line would be an incompatible, contrasting, and dominant addition to the existing landscape for persons involved in recreational activities and those using Stud Mill Road. In addition to being visible from Stud Mill Road, which the routes would closely parallel, the NRI would also be visible from a number of locations popular with recreationists, notably Eagle Mountain, Jimmie's Mountain, Narraguagus River, Machias River, and Pocomoonshine Lake. Viewer sensitivity to the Modified Consolidated Corridors, Consolidated Corridors, and Previously Permitted (No Action) Routes along the Stud Mill Road section of each route is likely to be high given the remoteness of the area. To the northeast of Baileyville, in the vicinity of the St. Croix River, the photograph and photosimulation (Figures H-15 and H-16, Appendix H) illustrate that the addition of a transmission line would be a dominant and contrasting addition to the existing landscape for persons involved in recreational activities, particularly boaters and anglers. However, although these routes are located close to recreational areas, these areas (e.g., Machias River) do not have particularly high use or visitation rates (see Table 3.9-1). The applicant would undertake mitigation measures to minimize visual impacts at the Narraguagus, Machias, and St. Croix River crossings. These would primarily involve placement of the support structures farther away from the Narraguagus and Machias Rivers. At the Narraguagus River, these would be located 290 ft (88 m) from the west bank and 500 ft (152 m) from the east bank. At the Machias River, these would be 210 ft (64 m) from the west bank and 360 ft (110 m) from the east bank. The St. Croix River stream crossing would be treated like a 75-ft (23-m) stream buffer for a trout stream (BHE 2005).

For the length of the MEPCO South Route between the Orrington Substation and Lincoln, the photographs and photosimulations (Figures H-1 through H-6 and H-17 through H-22, Appendix H) illustrate that the NRI would generally not be an incompatible and contrasting addition to the visual landscape. For the majority of this part of the route, the line would be located adjacent to one or more existing transmission lines and would not represent a significantly incompatible or contrasting aspect of the visual landscape. However, the NRI would be close to a number of residences and would therefore be a dominant aspect of the landscape as seen from these residences.

Along the length of Route 6 between Lincoln and Route 1 south of Topsfield, the photographs and photosimulations (Figures H-23 through H-32, Appendix H) illustrate that the line would generally not be an incompatible and contrasting addition to the visual landscape. For some of these locations, however, depending on the locations of residences, the line might represent a dominant addition to the visual landscape. At the majority of key observation points, the line would be visible from county roads where the line would represent a change in the visual landscape. However, given the height of the forest cover relative to the height of the support structures and conductors in this location, the impact of the transmission line on the visual landscape would be insignificant.

At locations northwest of Baileyville, in the vicinity of Grand Falls Flowage, the NRI would be co-located with the existing EMEC 69-kV transmission line. These two transmission lines would be dominant and contrasting additions to the visual landscape for persons involved in recreational activities at a number of locations, particularly boaters and anglers. Similarly, in the vicinity of the St. Croix River, the photograph and photosimulation illustrate that the addition of a transmission line would be a dominant and contrasting addition to the existing landscape

(Figures H-15 and H-16, Appendix H). Section 2.4.5 includes mitigation measures that the applicant would undertake to minimize visual impacts at the St. Croix River (e.g., letting the vegetation grow within 15 ft [4.6 m] of the conductors).

Given its length and closer location to local roads and residences, the MEPCO South Route would be seen by many more viewers. However, given the co-location of the route with existing transmission lines and other human activities, sensitivity to the NRI along this alternative would be lower at key observation points. The NRI would create less incompatibility with, contrast with, or dominance of the present visual landscape here than along the other alternative routes. Sensitivity to a line at the Penobscot River, Grand Falls Flowage, or St. Croix River might, however, be high, given the uniqueness of these locations for recreational activities. The line would likely create incompatibility or contrast with, or dominance of, the present visual landscape. However, although the route would be located close to recreational areas, these areas do not have particularly high use or visitation rates (see Table 3.9-1).

4.9.2.2 Rescission of the Presidential Permit

Under the Rescission of the Presidential Permit Alternative, BHE would not build the NRI. Therefore, there would be no visual resource impacts beyond those already occurring.

4.10 HEALTH AND SAFETY

Health and safety issues related to the construction, operation, and maintenance of transmission lines center on the potential effects from induced current and/or spark discharges, EMF, audible noise, O_3 production, use of herbicides for control of vegetation, and physical hazards. Homeland security issues are not examined as part of this EIS because the proposed transmission line presents no greater target for terrorists than any other high-voltage transmission line in the United States. The following discussion details the health and safety concerns relevant to the proposed project.[2]

4.10.1 Methodology

Generally, health and safety issues would be similar for all alternative routes. Potential differences among routes would primarily relate to the number of dwellings near the lines, ROW acreage requiring initial clearing and periodic maintenance, and amount of AC mitigation required for the M&N gas pipeline. The EMF impact analysis evaluated the potential electric and magnetic field levels from operation of the transmission line and identified the exposure to potential receptors at various distances from the ROW. In general, the farther removed a person

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2 Changes in EMF because of substation alterations associated with the proposed project would not be detectable at the substation fence lines. Therefore, the health and safety assessment related to EMF is limited to the operation of the proposed transmission line.

is from a transmission line, the lower the EMF strength.[3] Similarly, the noise impact analysis evaluated the potential noise levels generated during construction and operation of the proposed project and identified potential receptors for each of the alternative routes. The effects of construction and maintenance of the transmission line on worker and public safety were also evaluated on the basis of literature information on the health hazards for the proposed herbicides and statistics on public and worker fatality rates and worker injury rates that would be applicable to transmission lines.

4.10.2 Potential Impacts

4.10.2.1 Alternative Routes

4.10.2.1.1 Electric Shock Hazards. The greatest hazard from a transmission line is direct electrical contact with the conductors. However, this is more likely to occur from lower voltage transmission lines because they are closer to the ground compared with higher voltage lines. Physical contact between a grounded object and the conductor is not always necessary for electrical contact to be made, as under certain circumstances arcing can occur across an air gap (BPA 2001). The electric field created by a high-voltage transmission line extends from the energized conductors to other conducting objects such as the ground, vegetation, buildings, vehicles, and persons. Potential field effects can include induced currents, steady-state current shocks, spark-discharge shocks, and, in some cases, field perception and neurobehavioral responses.

- *Induced currents.* When a conducting object, such as a vehicle or person, is placed in an electric field, currents and voltages are induced. For example, it is not unusual for a fluorescent light tube to glow in the vicinity of high-voltage lines. The magnitude of the induced current depends on the electric field strength and size and shape of the object. The induced currents and voltages represent a potential source of nuisance or hazardous shocks near a high-voltage transmission line.

- *Steady-state current shocks.* Steady-state currents are those that flow continuously after a person contacts an object, such as a vehicle, and provides a path to ground for the induced current. The effects of these shocks range from involuntary movement in a person to direct physiological harm. Steady-state current shocks occur in instances of direct or indirect human contact with an energized transmission line.

- *Spark-discharge shocks.* Induced voltages appear on objects such as vehicles when there is an inadequate ground. If the voltage were sufficiently high, a spark-discharge shock would occur as contact is made with the ground.

3 The EMF strength is inversely proportional to the square of the distance from the line. (Thus, at 300 ft [91 m], the EMF strength would be one-ninth the strength at 100 ft [30 m].)

Spark-discharge shocks that create a nuisance could occur in instances of carrying or handling conducting objects, such as a metal irrigation pipe, under transmission lines.

- *Field perception and neurobehavioral responses.* When the electric field under a transmission line is sufficiently strong, it can be perceived by hair raising on an upraised hand. This is the effect of harmless levels of static electricity, similar to the effect of rubbing stockinged feet on a carpet.

The proposed transmission line would have the required ground clearance to reduce the potential for induced-current shocks. In addition, any permanent structures in the ROW, such as fences and metal buildings, would be grounded. Features reducing the level of potential for induced current in objects would also reduce the level of a possible induced-current shock.

When an overhead high-voltage line is near, parallels, or crosses an underground metal pipeline, AC voltages may be transmitted to the pipeline by conductive or inductive interference. Consideration must be given to the safety of workers and to the public who may come into contact with the aboveground portions of the pipeline such as valves and test stations. These exposed structures could cause a potential shock hazard when touched if the soil is at a significantly different potential. Nevertheless, pipelines and transmission lines can be located in close proximity to one another as long as appropriate measures are taken to mitigate potential adverse impacts of the transmission line on the pipeline.

As required, AC mitigation would be installed for the M&N gas pipeline to reduce the shock potential to industry standards (15 V/m), the let-go current threshold (threshold above which sustained muscular contraction would occur, thereby preventing a person from being able to let go of an energized object) (Southey and Dawalibi 1998). This mitigation would be required for all of the alternative routes. A discussion of the proposed AC mitigation is presented in Section 2.3.5.

The proposed line would be constructed in accordance with industry and BHE standards to minimize hazardous shocks from direct or indirect human contact with an overhead energized line (BHE 2005). Thus, the proposed project is not expected to pose a steady-state current shock hazard to humans.

In accordance with BHE’s transmission line standards (BHE 2005), the magnitude of the electric field would be low enough that spark-discharge shocks would occur rarely, if at all. The potential for nuisance shocks would be minimized through standard grounding procedures. Carrying or handling conducting objects, such as a metal irrigation pipe or any other long metallic objects, under transmission lines can result in nuisance spark discharges. The primary hazard with irrigation pipes or any other long metal objects, however, is electrical flashover from the conductors if the object is inadvertently brought close to the conductors. The transmission line would be constructed with adequate ground clearance to reduce this hazard.

Perception of the field associated with the transmission line would not be felt beyond the edge of the ROW. Persons working under the ROW might feel the field. Studies of short-term exposure to electric fields have shown that fields may be perceived (e.g., felt as movement of arm hair) by some people at levels of about 2 to 10 kV/m. However, studies of controlled, short-term exposures to even higher levels in laboratory studies have shown no adverse effects on normal physiology, mood, or ability to perform tasks (DOE 2005). The International Commission on Non-Ionizing Radiation Protection Guidelines recommend that short-term exposures to the general public be limited to 4.2 kV/m (ICNRP 1998). The exposures associated with the proposed action (discussed in the following section) would exceed this recommended limit only at the point of maximum conductor sag. Exposures would be less than or equal to 1.2 kV/m at the edge of the ROW for all alternatives.

> **Electric Fields**
>
> Electric field strength is measured in volts per meter (V/m) or in kilovolts per meter (kV/m). 1 kV = 1,000 V. Electric field strengths associated with transmission lines are generally < 10 kV/m and decrease rapidly with distance from the ROW.

4.10.2.1.2 Electric Field Effects.[4] As previously discussed, an electric field is generated by the voltage on the conductors of the transmission line and occupies the space between the conductors and other conducting objects. With the proposed line operating at 345 kV with any load, the calculated electric field at the left side of the ROW (facing the ROW from the Orrington Substation) at midspan would vary from about 0.23 kV/m to almost 1.2 kV/m (depending on whether there would be ROW sharing with existing lines). At the left edge of the ROW where the proposed line would share the ROW with existing transmission lines, the operation of the new line would leave the electric field virtually unchanged. At the right edge of the ROW (facing the ROW from the Orrington Substation), the field would be almost 1.2 kV/m along the entire route. This would be an increase from 0.13 kV/m (the current electric field level is approximately 185 ft [56 m] from the centerline of the existing 345-kV line). The electric field intensities would vary with location. The maximum ground-level intensities would be encountered only within a small portion of the ROW (e.g., less than 5%, at the point of maximum conductor sag) (DOE 1995). The maximum electric field within the ROW where the NRI would parallel the existing 345 kV line would be less than 7.0 kV/m (at a location between the two lines), while the maximum electric field where the NRI would be located within a separate ROW would be 5.5 kV/m (at a location under either of the outside conductors). The AC electric field intensities for the NRI would fall below 1.0 kV/m within about 100 ft (30 m) from the centerline of the ROW (where no ROW line sharing exists or off the eastern side where ROW line sharing would exist).

Field and laboratory animal studies have generally shown minimal or no impacts from power-frequency electric field strengths of 30 kV/m or less (DOE 1995). Other than stimulation

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4 The electric and magnetic fields that would be associated with the NRI were assumed to be equivalent to those calculated for the Previously Permitted Route presented by DOE (1995), because line design would be identical and ROW location would be similar to identical. The additional ROW spacing where the M&N gas pipeline would be located between the existing 345-kV line and the NRI (125 ft [38 m] rather than 100 ft [30 m]) would have a minimal influence on the calculated electric and magnetic fields (e.g., much less than the difference that would occur as a result of different power loads). The M&N gas pipeline would be located between the existing 345-kV line and the NRI for the majority of the 12-mi (19-km) distance between the Orrington Substation and Blackman Stream (Figure 2.1-2).

arising from electric charge induced on the surface of the body, the effects of exposures up to 20 kV/m are few and innocuous, while no effects on reproduction or development in animals have been observed at strengths greater than 100 kV/m (WHO 1998). Long-term exposure to the electric field in the proposed ROW would be unlikely; it is improbable that humans would remain in the ROW for more than a few hours. Little evidence exists of any significant biologic or health effects from electric fields at the strengths associated with transmission lines (Sagan 1992).

Magnetic Fields

Magnetic fields are measured in units of gauss (G) or tesla (T). Gauss is the unit most commonly used in the United States, while tesla is the internationally accepted scientific term. 1 T = 10,000 G. Magnetic field strengths associated with transmission lines and electrical appliances are generally in the milligauss (mG) or microtesla (μT) range. 1 μT = 10 mG.

4.10.2.1.3 Magnetic Fields. A magnetic field is generated by the current (movement of electrons) in the conductors, and the strength of the field depends on the current, design of the line, and the distance from the line. The ambient 60-hertz (Hz) magnetic field is about 0.1 milligauss (mG). At the edge of the NRI ROW, the magnetic field would be as high as 33 mG. Within new ROW segments, the magnetic fields up to 600 ft (180 m)[5] from the edge of the ROW (at 100-ft [30-m] intervals) would be 7.3, 3.0, 1.7, 1.0, 0.7, and 0.5 mG, respectively. However, where the NRI and the existing 345-kV line would occur within a shared corridor, the magnetic fields up to 600 ft (180 m) from the eastern edge of the ROW (at 100-ft [30-m] intervals) would be 4.3, 1.4, 0.6, 0.3, 0.2, and 0.1 mG, respectively. These magnetic fields are similar to maximum magnetic fields as a function of distance reported for 230- and 500-kV lines (NIEHS 2002a).

At distances of about 300 ft (90 m) from the edge of the ROW, the magnetic fields would be similar to typical background levels found in most homes (NIEHS 2002a). About 50% of homes average 0.6 mG or less (NIEHS 2002a). Sources of residential magnetic field exposures include distribution lines, building wiring, and appliances. The International Commission on Non-Ionizing Radiation Protection Guidelines recommend that magnetic field exposures to the general public be limited to 50 mG (ICNRP 1998).

Because electric fields do not penetrate the body, it is generally assumed that any biological effect from exposure to power-frequency fields must be due to the magnetic component of the field, or to the electric fields and currents that these magnetic fields induce in the body (Moulder 2004). Public concern exists over the potential adverse health effects that may be caused by long-term exposure to magnetic fields. Over the past several decades, a number of studies of this topic have raised questions about cancer and reproductive effects from exposure to magnetic fields. The consensus of scientific panels reviewing this research is that the evidence does not support a cause-and-effect relationship between magnetic fields and any adverse health

5 A distance of 600 ft (180 m) from the edge of the ROW was analyzed in the EIS for the Previously Permitted Route (DOE 1995). It is also the distance selected for the visual resource assessment for residents by the applicant (BHE 2005). Therefore, this distance was also selected for assessing magnetic fields for the NRI.

outcomes (e.g., AMA 1994; NRC 1997; NIEHS 2002b). Some research continues of the statistical association between magnetic field exposure and a rare form of childhood leukemia known as acute lymphocytic leukemia. A review of this topic by the World Health Organization (WHO 2001) concluded that this association is very weak.

Magnetic fields are classified as possibly carcinogenic to humans (WHO 2001). This classification denotes an agent for which there is limited evidence of carcinogenicity in humans and less than sufficient evidence of carcinogenicity in experimental animals. Other agents with this classification include coffee, gasoline engine exhaust, and welding fumes (WHO 2001). This classification is the weakest of the three categories ("carcinogenic to humans" [e.g., asbestos, tobacco, and gamma radiation], "probably carcinogenic to humans" [diesel engine exhaust, sun lamps, and ultraviolet radiation], and "possibly carcinogenic to humans") used by the International Agency for Research on Cancer to classify potential carcinogens based on published scientific evidence (WHO 2001).

Havas (2000) stated that the epidemiological evidence indicates that there is an association between extremely low-frequency EMF and some forms of childhood and adult cancer. The association seems to be one of promotion rather than initiation. Ahlbom et al. (2000) did not find any evidence for an increased risk of childhood leukemia at residential magnetic field levels less than 4 mG, but did find a statistically significant relative risk of 2 for childhood leukemia for children with residential exposures greater than 4 mG during the year prior to diagnosis. Less than 1% of the subjects were in the highest exposure category. However, there have been no reproducible laboratory findings demonstrating biological effects of magnetic fields below 1,000 mG (Ahlbom et al. 2000). Li et al. (2002) concluded that prenatal maximum magnetic field exposure above a certain level (possibly around 16 mG) may be associated with increased miscarriage risks. A nonsignificantly increased risk of brain cancer was observed among men who had ever held a job with an average magnetic field exposure greater than 6 mG relative to those with exposures less than 3 mG, with a cumulative time-weighted index score of magnetic field exposure being significantly related to one type of brain cancer (i.e., glioblastoma multiforme). This supports the hypothesis that occupational magnetic field exposure increases the risk of brain cancer (Villeneuve et al. 2002).

Because no human health hazards from exposure to magnetic fields from transmission lines have been proven to exist, it is impossible to rationally define a safe distance or safe exposure level (Moulder 2004). Although no Federal standards exist for magnetic fields for transmission lines, two States do have such guidelines. In Florida, the magnetic field level at the edge of the ROW can vary between 150 to 250 mG (depending upon line voltage and whether it is an existing or new ROW). The guideline for New York is 200 mG at the edge of the ROW (NIEHS 2002a). The expected EMF strengths at the edge of the ROW for the NRI would fall well within these guideline levels. Consequently, the operation of the NRI is not anticipated to cause adverse health effects due to magnetic field exposure. Although the NRC (1997) noted that power-frequency fields have not been proven scientifically to be harmful, they did recommend the adoption of a policy of prudent avoidance.

A discussion of the experimental investigations of EMF effects (particularly at the cellular level) is beyond the scope of this EIS. More information on these studies can be obtained in recent EMF reviews by the NRC (1997) and NIEHS (2002b).

Regardless of the alternative route, the NRI would generally contribute only a small portion of the total magnetic field exposure that a person would receive. People residing near the NRI would be among those most likely to receive magnetic field exposure from the line. Table 4.10-1 lists the number of dwellings within 600 ft (180 m) from each alternative route. Thirty-five of the dwellings occur within the initial 12.2-mi (19.6-km) segment from the Orrington Substation, which would be identical for all four alternative routes. The number of residents exposed to elevated magnetic fields would be highest for the MEPCO South Route and least for the Modified Consolidated Corridors and Consolidated Corridors Routes. Less than half of the dwellings for any of the alternative routes would be within 300 ft (91 m) of the ROW.

TABLE 4.10-1 Dwellings within 600 Feet of the NRI ROW for the Alternative Routes

	Number of Dwellings for the Alternative Routes[b,c]			
Distance from Edge of ROW (ft)[a]	MCCR	CCR	PPR	MSR
0 to 100	4 (4)	6 (4)	4 (4)	20 (4)
100 to 200	5 (5)	9 (5)	5 (5)	16 (5)
200 to 300	5[d] (1)	5 (1)	1 (1)	11 (1)
300 to 400	5 (5)	10 (5)	5 (5)	17 (5)
400 to 500	8 (7)	14 (7)	11[d] (7)	22 (7)
500 to 600	13 (13)	15 (13)	13 (13)	35 (13)
Total:	40 (35)	59 (35)	39 (35)	121 (35)

[a] To convert feet to meters, multiply by 0.305.

[b] CCR = Consolidated Corridors Route, MCCR = Modified Consolidated Corridors Route, MSR = MEPCO South Route, PPR = Previously Permitted Route.

[c] Numbers in parentheses are for the initial 12.2-mi (19.6-km) segment leading out of the Orrington Substation that would be identical for all alternative routes.

[d] Includes four seasonal camps.

Source: Paquette (2005x).

> **Noise**
>
> Noise is defined as sound that is undesirable because it interferes with speech, communication, or hearing; is intense enough to damage hearing; or is otherwise annoying.

4.10.2.1.4 Audible Noise and Ozone Effects. Audible noise would occur from construction and maintenance activities and, to a lesser extent, operation of the proposed project. The physical unit most commonly used to measure sound is the decibel (dB). The higher the energy carried by the sound, the louder the perception of that sound, and thus the higher the dB rating of the sound. A sound level of just above 0 dB is approximately the threshold of human hearing and is barely audible under extremely quiet listening conditions. Normal speech has a sound level of approximately 60 dB. The dB scale is logarithmic, meaning that a 60-dB sound is perceived as approximately twice as loud as a 50-dB sound (not a 30-dB sound). Humans can barely perceive loudness changes of less than 2 to 3 dB.

The second important characteristic of sound is its tone or frequency, which is the number of times per second the air vibrates, measured in Hertz (Hz). The human ear is most sensitive to frequencies in the 1,000- to 4,000-Hz range. To account for the variable response of the human ear to different tones, decibels may be adjusted to A-weighted decibels [dB(A)]. The dB(A) represent the human hearing response to sound.

The predominant noise sources in the semiurban areas (particularly near Bangor) include traffic and aircraft, and wind in the trees. High ambient noise levels in these areas are 60 to 70 dB(A). In more remote areas, high noise levels from more infrequent traffic or aircraft would be 40 to 50 dB(A) (Shafer et al. 1990).

Construction and maintenance activities would occur during daytime hours when noise is tolerated more than at night. Potential impacts on ambient noise would be expected to be temporary and intermittent in nature. Construction activities would include a wide array of activities, including temporary access road construction, ROW clearing, grading, drilling, blasting, cleanup, and revegetation. Many of the noise sources associated with NRI construction would be consistent with ongoing forest harvesting operations that are common in the project area. The noise levels generated by construction equipment would vary significantly, depending on such factors as type, model, size, and condition of the equipment; construction schedule; and condition of the area where the work is being conducted. In addition to daily variations in activities, major construction projects are accomplished in several different stages and areas. Each stage has a specific equipment mix, depending on the work to be accomplished.

Average noise levels for typical construction equipment range from 74 dB(A) for a roller to 101 dB(A) at a pile driver (upon impact). Most construction equipment (e.g., front-end loaders, concrete mixers, cranes, generators, graders, shovels, and trucks) have noise levels between 81 and 88 dB(A) at 50 ft (15 m), 68 to 74 dB(A) at 250 ft (76 m), and 61 to 68 dB(A) at 500 ft (152 m) (HMMH 1995). Construction-related noise levels would exceed the EPA (1974) guideline for residential L_{dn}[6] noise [55 dB(A)] for a distance of about 1,640 ft (500 m). These

6 L_{dn} is defined as the A-weighted average sound level during a 24-hour period with a 10-dB weighting applied to nighttime sound levels.

distances are conservative, as noise levels would be attenuated by factors such as air absorption and ground effects due to terrain and vegetation.

Noise levels associated with construction-related vehicular traffic (e.g., hauling of materials and construction equipment in and out of construction sites and worker commutes) would increase and decrease rapidly. The peak pass-by noise level of a heavy truck operating at 50 mph (80 kph) would be about 83 dB(A). On the basis of an 8-hour daytime shift, the noise level (L_{dn}) at 50 ft (15 m) for one truck per hour would be 46 dB(A) and for 10 trucks per hour would be 56 dB(A) (Menge et al. 1998). These noise levels would decrease notably with distance. Noise levels would be reduced by approximately 6 dB(A) for each doubling of distance from the source. For example, a 75-dB(A) noise heard at 50 ft (15 m) from the source would be reduced to 69 dB(A) at 100 ft (30 m) away from the source. Again, this does not include the additional attenuation of noise by woody vegetation, structures, or terrain elevations. Therefore, except for receptor locations in close proximity to the road, noise levels would be below the EPA guideline of 55 dB(A) as L_{dn} for residential zones (EPA 1974).

The blasting sound level limit at any protected location would not exceed 129 dB for one blast per day or 123 dB for the four blasts per day limit (BHE 2005).

Noise associated with either NRI construction or installation of AC mitigation would be intermittent during the construction period at any single location. Those in the vicinity of the project would hear the construction noise, but the overall impact would be temporary. Nighttime noise due to construction would not occur, since construction would be limited to daylight hours.

Regular maintenance activities (e.g., line surveys and vegetation maintenance) would involve light- or medium-duty vehicle traffic with relatively low noise levels. More noisy activities (e.g., use of chainsaws) would be infrequent. The anticipated level of noise from maintenance activities would be far lower and of shorter duration than that from construction.

Operation of a transmission line can result in noise impacts from corona, which is the electrical breakdown of air into charged particles caused by the electrical field at the surface of conductors. Corona-generated audible noise from transmission lines is generally characterized as a crackling or hissing noise. The expected levels of noise from a 345-kV transmission line falls within the range of that for a library (30 to 40 dB) and an office (50 to 60 dB) (AMEC 2002). For the NRI, audible noise from corona during wet weather would be about 45 dB(A) directly underneath the line, 42 dB(A) at the edge of the ROW, and 36 dB(A) at 250 ft (76 m) from the centerline. The noise levels at the edge of the ROW would be below the most stringent noise level requirements established by the MDEP State Location Law (Shafer 2005). Modern transmission lines are designed, constructed, and maintained so that during dry conditions, they will operate below the corona inception voltage; that is, the line will generate a minimum of corona-generated noise. During dry weather conditions, noise from the NRI would generally be indistinguishable from background noise [35 dB(A)] at locations beyond the edge of the ROW. The greatest potential for noise-related impacts would be during wet weather near residential dwellings or when recreationists in remote areas would pass directly under the conductors. Even then, the audible noise levels would be minimal and the exposure would be short-term and localized.

Corona effects from transmission lines can also include the production of O_3. No adverse health effects are expected from O_3 produced by the NRI regardless of alternative route (Section 4.1.2).

The primary effect of noise generated would probably be one of annoyance to residents or others nearest the ROW during the construction period. More residents would be exposed to noise from the construction of the MEPCO South Route and fewest for the Modified Consolidated Corridors and Consolidated Corridors Routes on the basis of the number of dwellings within 600 ft (183 m) of the ROWs (Table 4.10-1). However, those seeking more remote recreational opportunities would be affected least along the MEPCO South Route because it has the least remote recreational use. Construction workers would be located closer to the noise sources and would experience longer exposure durations than the public. They would follow standard industry and Occupational Safety and Health Administration (OSHA) procedures for hearing protection.

4.10.2.1.5 Effects on Cardiac Pacemakers. Currents and voltages that are introduced internally to the body represent a possible source of interference to cardiac pacemakers. Both electric and magnetic fields have been found to introduce electromagnetic interference (EMI) that can alter the function of some older (no longer commercially available) cardiac pacemakers. Such pacemaker models could misfunction in an electric field of 2 kV/m or more. The percentage of individuals alive today with older pacemakers is extremely low; only 2.5% of such individuals were at risk in the mid-1980s (WHO 1987). Furthermore, the fraction of those individuals at risk who would be likely to encounter a source of EMI (including the proposed transmission line) during a period when their cardiac function was dependent upon their pacemaker is extremely small (WHO 1987). The occupational exposure guidelines developed by the American Conference of Governmental Industrial Hygienists state that workers with cardiac pacemakers should not be exposed to a 60-Hz magnetic field greater than 1,000 mG (NIEHS 2002a). This magnetic field level is much greater than that associated with high-voltage transmission lines.

Because only minimal differences in EMF would exist among the alternative routes, there would be no significant differences in potential risks to people with pacemakers for the alternative routes. Even when older pacemaker models susceptible to reversion were more prevalent, apparently no accidents resulted from exposure of a pacemaker patient to an AC transmission line. The combination of circumstances that would lead to an accidental event is extremely rare (approaching zero, considering the small number of individuals who still have older models). People driving under a high-voltage transmission line are at an even lower risk from pacemaker problems because the metal of the vehicle would serve as a shield from an external electric field.

4.10.2.1.6 Herbicide Use in ROW Management. Vegetation management practices for the proposed project would primarily consist of a combination of hand cutting and selective herbicide application (TRC 2005b). Mechanical mowing would only be used in unusual circumstances to regain control of vegetation (BHE 2004). Only herbicides registered with the

EPA and the State of Maine would be used to retard the development of tall-growing vegetation that might compromise the integrity and safety of the transmission line. Areas near public water supplies, open waters, wetlands, springs, wells, homes, or roadsides would be managed by manual removal of undesirable vegetation.

As discussed in Section 2.3.6, BHE plans to use herbicides whose active ingredients include fosamine, glyphosate, and imazapyr. The application methods that would be used to maintain the NRI ROW (e.g., backpack sprayers) require the most hands-on use of herbicides and, therefore, carry the greatest risk of exposure to workers. The general public is less likely to receive repeated exposures than those who apply herbicides, since the ROW locations would be mostly remote and the timing of treatments would be widely spaced temporally and spatially. Also, the low volatility of the herbicides that would be used, coupled with selective ground-level application techniques, would limit exposure levels.

Herbicides would be applied to any given area of the proposed route about once every 4 years, thus limiting the opportunity for exposure of the public. Also, basal application methods would limit the potential for movement of herbicides away from the targeted vegetation. Most members of the public who would be present within the ROW would either be on vehicles (ATVs, snowmobiles, or canoes), be present when herbicides are not used (fall and winter), or be wearing clothing that would limit skin exposure (long pants and long-sleeve shirts).

The herbicides being considered by the applicant (Arsenal,® Accord,® and Krenite®) cause little or no adverse health effects when applied according to label directions (BPA 2000; Information Ventures, Inc. 1995; Smith and Oehme 1992). Use of standard mitigation practices would further minimize the risks associated with herbicide use (Section 2.4.5). Utilitywide experience with herbicides has shown that these potentially hazardous materials can be used safely if appropriate precautions are implemented. Herbicides offer a viable alternative or complement to mechanical methods such as mowing, grading, or the use of chain saws, both in terms of cost and reduced worker exposure to injury from equipment (DuPont 2005)

4.10.2.1.7 Radio and Television Interference. Radio interference or static noise is a general term used in reference to any undesirable disturbance of the radio frequency band, which ranges from 3 kHz to 30,000 MHz. The magnitude of corona-generated radio noise decreases with increasing frequency and is very low at frequencies above 10 MHz. Of particular concern are those frequencies at which corona discharge associated with transmission lines can interfere with radio and television reception (i.e., the AM broadcast band [535 to 1,605 kHz] and the lower television broadcast bands [channels 2 to 6 at 54 to 88 MHz]). The degraded reception is referred to as radio interference (RI) or television interference (TVI). Interference is generally noticed on AM broadcast bands when the receiver is located very close to a transmission line (e.g., in a car passing under the line). The FM broadcast range from 88 MHz is unaffected by pulsative-type noise. The RI and TVI related to gap sparking of transmission lines generally is caused by defective or loose fittings of line hardware and can be remedied by routine maintenance of those fittings.

The level of corona-generated frequency noise is quite small in the very high frequency range used for television transmission. Generally, if the AM radio reception near a particular line is acceptable, then TVI would not be a problem. Ghosting is the only TV problem that may result from the proposed line. The audio portion of a TV signal is an FM radio system that is not subject to static types of interference.

The applicant has calculated RI levels at the edge of the ROW.[7] For a frequency of 1 MHz, the calculated RI is 68 dB or less during heavy rain, 60 dB or less during wet conductor conditions, and 43 dB or less during fair weather conditions. However, RI levels decrease rapidly with increasing distance from the line. At 100 ft (30 m) from the edge of the ROW, the estimated RI level drops to 49 dB or less during heavy rain, 40 dB or less during wet conductor conditions, and 23 dB during fair weather conditions. Given a signal-to-noise ratio equivalent of 20 dB for satisfactory radio reception and a 70-dB radio broadcast signal for the primary service area, AM radio reception at the edge of the ROW should be satisfactory, except when conductors are wet or heavy rain is occurring. At distances greater than 100 ft (30 m) from the edge of the ROW, radio reception should be satisfactory during all weather conditions.

The level of TVI is considerably lower than that associated with RI. Thus, the incidence of TVI from the NRI should be of minor consequence. Ghosting can generally be alleviated by repositioning the antenna. TVI would not be expected to be a concern for digital cable or satellite TV systems.

The potential for RI and TVI would be highest for the MEPCO South Route as it would have 20 dwellings within 100 ft (30 m) of the ROW, compared with 6 or less for the other alternative routes. Also, the MEPCO South Route has more highway crossings than the other alternative routes; thus, the potential for RI for vehicles would be higher.

4.10.2.1.8 Physical and Biological Hazards. Construction and maintenance workers for any project are subject to risks of injuries and fatalities from physical hazards. Indirect impacts on workers can include dehydration, heat exhaustion, hypothermia, insect stings, falls, and exposure to poisonous plants (BPA 2000). While such occupational hazards can be minimized when workers adhere to safety standards and use appropriate protective equipment, fatalities and injuries from on-the-job accidents can still occur. Rates of accidents have been tabulated for all types of job categories, and risks can be calculated on the basis of industrywide statistics. Where possible, these statistics have been used to estimate the risk for construction of the NRI, which would have a greater potential risk to workers than would maintenance of the transmission line.

In 2003, 49 total fatalities occurred nationwide for workers employed in the “power and communication line and related structures construction” field of more than 116,000 workers; there were 14 total fatalities for the electric power transmission, control, and distribution field out of about 162,000 workers (U.S. Bureau of Labor Statistics 2004, 2005b). Therefore, the fatality rate for constructing a transmission line can be estimated at 0.004%, while the fatality

[7] The RI values were calculated for the Previously Permitted Route evaluated by DOE (1995), but they would be applicable for the NRI alternative routes.

rate for transmission line operation and maintenance can be estimated at 0.009%. No distinctions are made among categories of workers (e.g., supervisors and laborers) because the available fatality and injury statistics by industry are not sufficiently refined to support analysis of worker rates in separate categories.

Incidence rates of nonfatal occupational injuries and illnesses during 2003 were 6.9 per 100 full-time workers for the utility system construction field (which includes water and sewer and oil and gas pipelines as well as electric and communication systems) and 4.9 per 100 full-time workers for the electric power transmission, control, and distribution field (U.S. Bureau of Labor Statistics 2005b).

It is assumed that 100 construction workers would be required for the Modified Consolidated Corridors Route, Consolidated Corridors Route, or Previously Permitted Route, and that 140 construction workers would be required for the MEPCO South Route (Section 4.7.2). It is assumed that, in general, the types of activities required of these employees would be similar to those for workers in the power and communication line and related structures construction sector. On the basis of this assumption and a fatality rate of 0.004%, the number of fatalities from constructing the NRI would be less than 1 (0.4 for the Previously Permitted, Consolidated Corridors, and Modified Consolidated Corridors Routes and 0.6 for the MEPCO South Route).

Potential fatalities per year for maintenance would be even less than for construction. Few field personnel would be required to maintain the NRI. Even if 10 crew members were used for line maintenance, the number of fatalities expected would be much less than 1 (0.09 fatalities). The potential for fatalities would be slightly higher for the MEPCO South Route since it would require more maintenance on the basis of having the highest acreage of ROW compared with the other alternative routes.

The estimated annual number of nonfatal occupational injuries and illnesses for construction of the NRI would be 6.9 for the Modified Consolidated Corridors Route, Consolidated Corridors Route, or Previously Permitted Route, based on 100 construction workers required to construct any of these routes. For the MEPCO South Route, the estimated number of injuries and illnesses would be 9.7, based on 140 workers required for construction. On the basis of 4.9 nonfatal injuries and illnesses per 100 full-time workers for maintenance, the annual number of injuries and illnesses would be expected to be less than 1 in 10 full-time field personnel. The potential for injuries or accidents would be slightly higher for the MEPCO South Route compared with the other alternatives because of the acreage that could require maintenance.

The potential fatality and injury rates would be similar for the installation of AC mitigation for the M&N gas pipeline. However, the primary activity would be the need to excavate an 18-in. (46-cm)-deep trench for the zinc ribbon though an area dominated by grasses and forbs (Section 2.3.5). This would be less hazardous than tree clearing and the construction and installation of a transmission line. Differences among routes would depend on the amount of mitigation required: approximately 68 mi (109 km) each for the Modified Consolidated

Corridors, Consolidated Corridors, and Previously Permitted Routes and 45 mi (72 km) for the MEPCO South Route.

The potential would exist for ATVs and snowmobiles to collide with the NRI support structures or guy wires. However, the fatality risk for ATV or other off-road motor vehicles is 1 in 371,058 (<0.0003%). The potential, however slight, would exist for logging operators to contact energized conductors. The fatality risk for exposure to electric current from transmission lines is 1 in 2,641,663 (<0.00003%) (National Safety Council 2005). The potential for a plane striking the NRI would be negligible. The marker balls used to minimize bald eagle collisions would also make the line more visible to small plane pilots that may use the rivers for navigation. Overall, the potential for a death to the member of the public related to the NRI would be negligible.

4.10.2.2 Rescission of the Presidential Permit

Under the Rescission of the Presidential Permit Alternative, BHE would not build the NRI. Therefore, there would be no health and safety impacts beyond those already occurring.